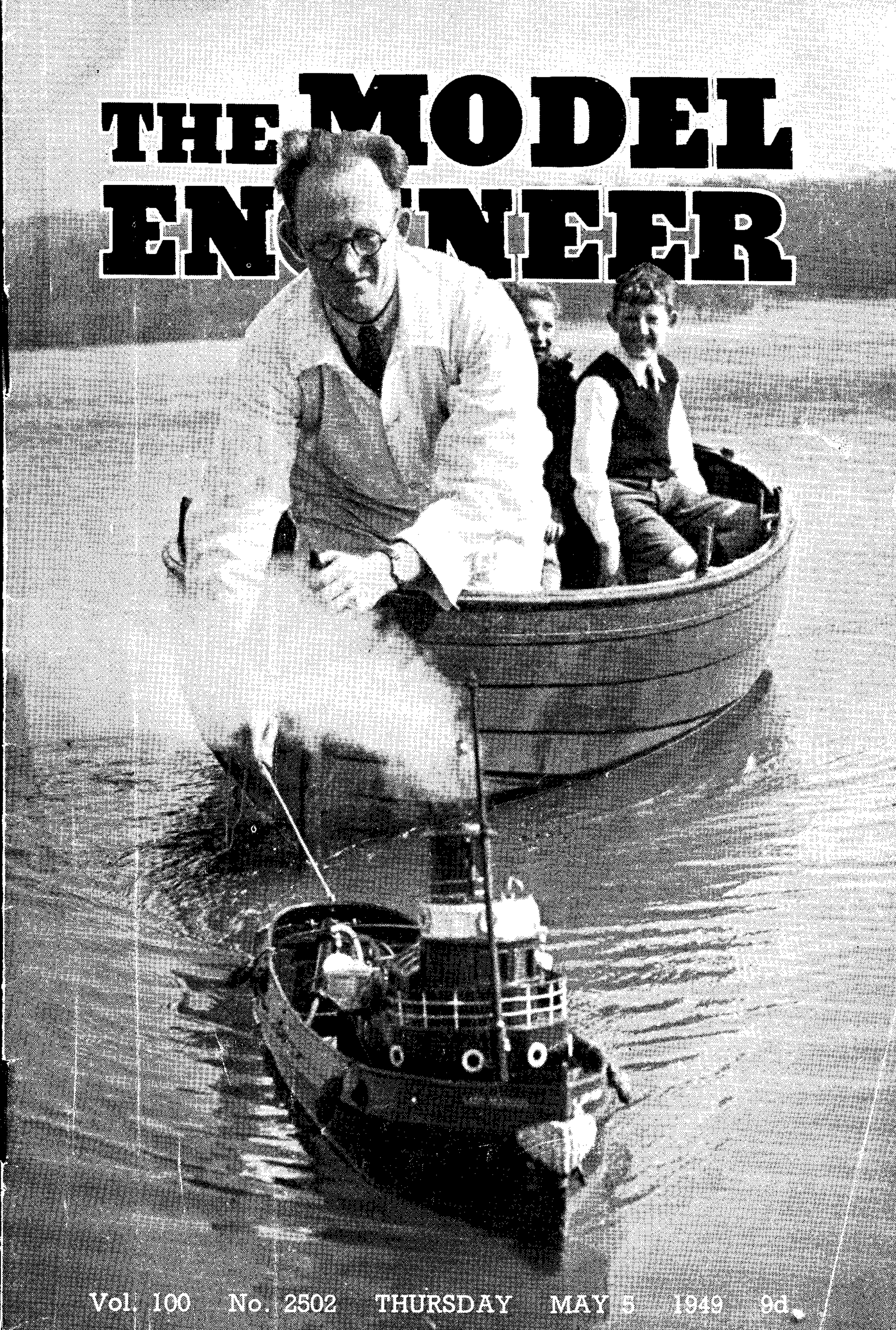
THE MODEL ENGINEER



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The MODEL ENGINEER

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5TH MAY 1949 VOL. 100 NO. 2502

SMOKE RINGS

The Paper Quota

● THE RECENT announcement in the House of Commons, to the effect that as from July next, post-war periodicals will probably enjoy an increase of about 100 per cent. in the amount of paper they can consume, while pre-war publications will be allotted about 50 per cent. more has given pleasure to most people concerned.

To us, it marks an occasion on which we have to indulge in even quicker thinking than usual; for the first reaction is that we shall at last have an opportunity to do several things which, for a long while we have been itching to do, but could not do because of the paper shortage.

However, we must be careful to avoid taking a false step by yielding to the obvious temptations! Already we are investigating the possibilities that arise as a result of the altered circumstances, and it is too early yet to make a definite pronouncement. An addition to the number of pages per issue, a widening of the field of interest, or a general policy of expansion are all being considered. But the first and most obvious need is to ensure that sufficient copies are available to guarantee a supply to every potential reader.

One important result of this forecast development, however, is that we shall require an increased flow of contributions which may dea with all kinds of small-power engineering and electrical subjects. And we would add that articles from new contributors will be especially welcome.

A Cheltenham Exhibition

● MR. J. S. BURGESS, hon. secretary of the Cheltenham Society of Model Engineers, advises us that, in connection with the local annual flower-show on Tuesday, Wednesday and Thursday, June 21st, 22nd and 23rd, the society will be holding an exhibition of models built by its members. A similar exhibition was held two years ago and was an unqualified success, and we hope that the second venture will prove to be at least as successful.

A Prize for Locomotive Builders

● MR. W. R. WAUGH, whose "Wilwau" castings are well known to builders of miniature locomotives, has generously contributed a set of castings for "L.B.S.C.'s" "Doris" to the list of prizes to be awarded at the "M.E." Exhibition, and will be designated the "Wilwau" Castings Prize. It is to be awarded, at the discretion of the judges, to the builder of any appropriate exhibit deserving of encouragement.

Our Cover Picture

● THE HIGH performance of small power models is often a surprise, and indeed, a revelation, to those who have regarded them as mere toys. Many references have been made, both in the technical and lay press, to the prodigious hauling feats of small locomotives, but it is not so well known that the model power boat is capable of living just as truly up to its title. On many occasions, towing races have featured in model power boat events, and the tractive power of the boats is demonstrated by the ease with which they tow a boat or raft with one or more passengers. As might logically be expected, the model tug is one of the most efficient types of boats for this purpose, and will faithfully emulate the performance of its prototype by towing loads considerably greater than its own size and weight. Our photograph shows the steam tug *Lady Marion*, towing a rowing boat on Ruislip Reservoir, piloted by its constructor, Mr. S. R. Emery, of the Harrow Society of Model Engineers, with his two children as passengers. A further photograph of the boat and constructor, showing hull and deck fittings in greater detail, is reproduced on this page.

The prototype of this boat is one of two ocean-going tugs stationed at Avonmouth. The model is 4 ft. long by 10 in. beam and is equipped with a steam plant comprising a centre-flue boiler, fired by a paraffin vaporising burner and a 2-cylinder compound Stuart engine geared to a 4 in. three-bladed propeller.

In addition to the tug *Lady Marion*, Mr. Emery has also constructed a very fine paddle steamer *Lady Betty* and several other types of model, including a 2-6-0 3½-in. gauge mixed-traffic locomotive, and has an 0-6-0 3½-in. gauge locomotive in course of construction.

Corrigendum

● BY SOME extraordinary accident, the first name in the list of "M.E." Exhibition judges, as printed in our issue for April 21st, was endowed with an exalted rank and style which do not exist. The name should have appeared as Lt.-Com. J. H. Craine, R.N.R. (Ret.), and we offer our apologies for the error that was made.

Geared Steam Locomotives

by Kyrle W. Willans

THE writer was in charge of that branch of the Railway Department of the Sentinel Waggon Works, which dealt with industrial locomotives, from 1924 to 1927, and during that period a very large number of steam locomotives were supplied to every variety of industrial user.

remembers the first roadless tractor built, in which the cross member carrying the tracks was a piece of H-section joist set across the frame. As can well be imagined, as soon as the tractor moved off, the web bent over, as does a piece of sheet steel in a folding machine.

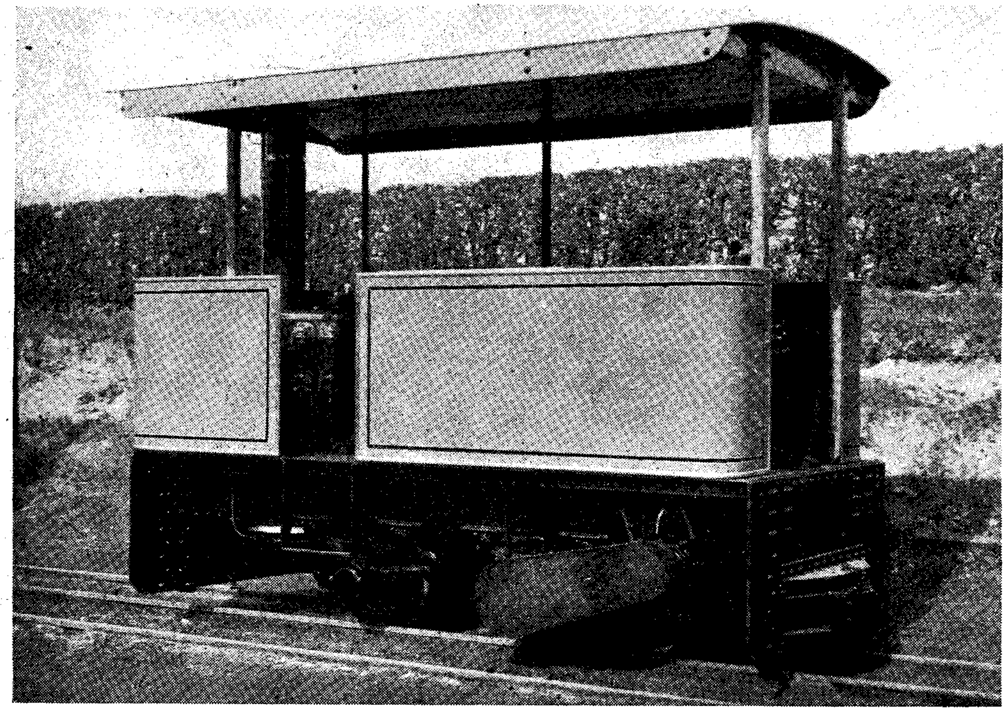


Photo No. 1. An early design of narrow-gauge locomotive

In the course of turning out old papers prior to a move of house, he has come across a number of photographs illustrating Sentinel locomotives of that period, and it may be that some will be found of interest to readers of THE MODEL ENGINEER. The writer remains convinced that there is definite room for small steam locomotives for narrow-gauge railways of the type used by contractors, and one of these days he would like to put forward a specification for such a locomotive. Meantime, here are photographs of locomotives which were built in numbers and did give good service.

The unregenerate used to say of the Sentinel, in those days, that their trademark should not be the figure of an armed warrior, but of two pieces of steel joist held together by a cleat and rivets. It was beyond question that there was far too much of that sort of work, and the writer well

One illustration shows the early design of narrow-gauge locomotive and, incidentally, a design that ran parallel with the writer's design right down to the time of his leaving the firm. The second illustration shows the writer's design for a narrow-gauge locomotive applicable to all gauges of track between 24 in. and 36 in., and convertible at will from one gauge to another, by changing the axles and the position of axle-boxes, chain sprockets, and radius-rods.

In the case of the "convertible gauge" locomotive, it will be noticed that the locomotive is set much lower, although the wheel diameter was the same in both designs, so low, in fact, that no step was required between ground and footplate.

The frame consisted of two fore and aft members closed in at either end by buffer-beams. Stiffeners between the buffer-beams were pro-

vided by flat plates extended upwards to form supports for the circular water tank. The standard Sentinel boiler was carried on angles riveted to the after tank support and to the wide frames, while the standard Vertical Sentinel engine was carried off the frames in standard spherical engine supports bolted to the frames in question. The torque of the engine was taken by a tie-bolt made fast to the forward tank support. As can be seen from the photograph, the sandboxes were carried saddlewise on the water tank. The coal bunker was situated on one side of the boiler while, on the other side, the reversing lever was placed as in ordinary small locomotive practice.

In addition to the transverse members already referred to, there were additional cross members carrying the springs which bore on hard steel inserts attached thereto. The drive was from engine to leading axle by one chain and thence from leading axle to trailing axle by a coupling chain. The casing around the engine came off with the minimum of trouble for gland tightening, etc., while the mechanical lubricator was perched on the side frame on the chain pinion side of the engine.

The third photograph shows one of three engines supplied to the engineers responsible for the construction of a large reservoir in Derbyshire. Public works contractors were big buyers of Sentinel locomotives at that time. These locomotives were built in two sizes, 6 and 8 tons in weight, but always with identical engines and boilers. The extra weight for the 8-ton locomotives was obtained by the simple expedient of fitting a *cast-iron* water tank of considerable thickness, and cast-iron buffer-beams. It was very much cheaper in those days to buy and fit a heavy cast-iron tank, than to buy and fit a steel tank and lumps of cast-iron block ballast.

It will, of course, be appreciated that a double-cylinder steam engine, 6-in. bore, 9-in. stroke working at 230 lb. pressure, was far too powerfu for even an 8-ton locomotive, but, on the other hand, it was a standard engine and manufactured very cheaply on that account.

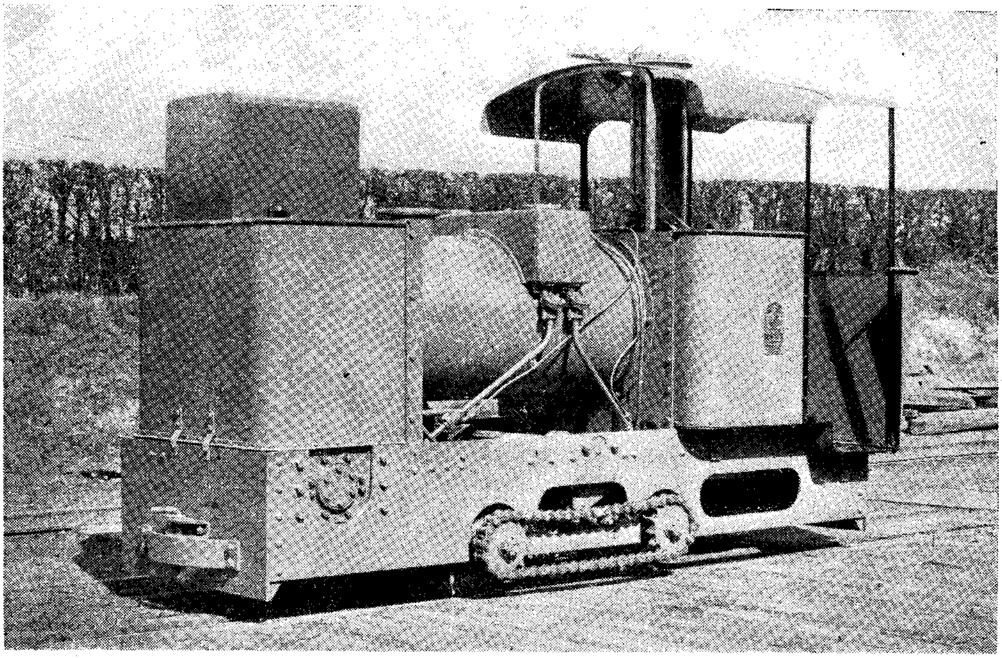


Photo No. 2. The author's design for a "convertible gauge" narrow-gauge locomotive

The writer is confident, in his own mind, that a steam locomotive built on these lines with either a "monotube" or a "Derr" type boiler and a steam engine capable of a maximum output of say 45 b.h.p., would give the diesel locomotive of the present day a very considerable shaking up.

The brake equipment took the form of the normal type shoe brakes acting on the tyre, and the standard Sentinel system of reversing the engine, sucking back from the exhaust pipe, and building up a pressure in the steam pipe between regulator and engine. Of all the crude and horrible arrangements, this was probably the most horrible, as soot and cinders were pumped back into the engine; but it worked and was employed on every Sentinel waggon.

The writer vainly endeavoured to get the powers-that-be to modify the arrangement by building up the pressure in the exhaust pipe, by means of a valve which, at the time of closing the exhaust, opened a valve in the main steam pipe so that the engine sucked in cool atmospheric air and compressed it into the exhaust pipe.

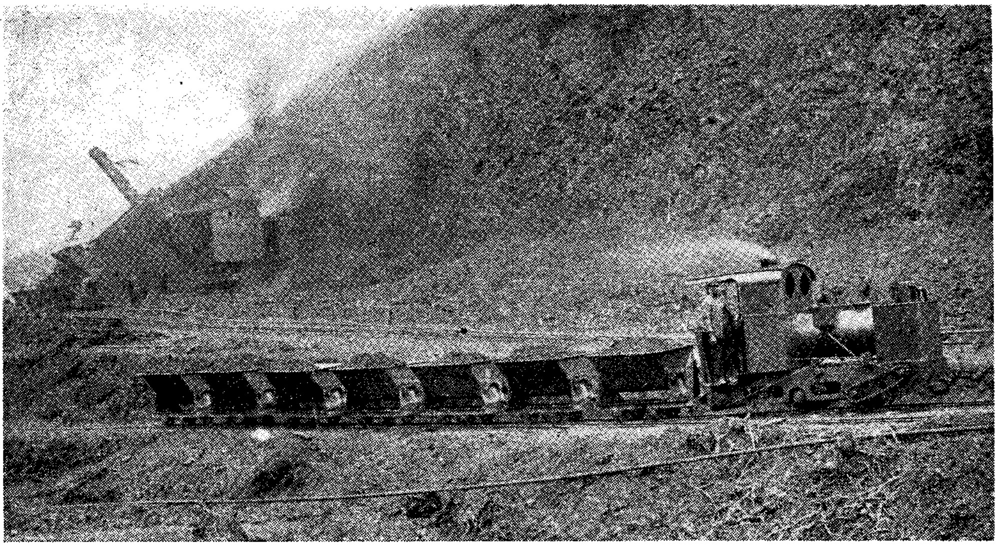


Photo No. 3. A narrow-gauge locomotive at work on the construction of a reservoir

The powers-that-be were adamant on its unsuitability, mainly on the old familiar grounds that if it had been a good idea it would have been thought of before. In later years, after leaving the Sentinel, the writer tried it out and it worked perfectly. One great advantage lay in the fact that, by its use, it was not necessary to reverse the engine to operate the brake, as in the case of the Sentinel device.

In the 1920's the Sentinel Waggon Works was a fine firm to work for so long as one steered clear of criticism of existing designs, many of which, especially the engines themselves, were very good indeed, in economy, get-at-ability, and cost. The designers did, however, love to build frames, and structures generally, up from rolled steel sections attached to each other by cleats and rivets, when there were other and better ways of manufacturing the structure in question.

For the Bookshelf

Locomotives Worth Modelling. By F. C. Hambleton. (London: Percival Marshall & Co. Ltd.) 170 pages, size 6 in. by 9 in. Price 10s. 6d.

For some years, the title of this book has been familiar to readers of THE MODEL ENGINEER as that common to a long series of articles which have made their author's name famous. The contents of this book have been largely collated from the articles mentioned, but the text has been revised and rearranged, with the result that the book is a delight to the locomotive enthusiast as well as a godsend to the locomotive modeller.

The illustrations in the text consist entirely of drawings of locomotives together with some of their details of which precise information is often very difficult to obtain.

The locomotives selected belong generally to what may be regarded as the later intermediate period of development, i.e., the 1880's and 1890's; this covers a most interesting phase and includes several of the most famous locomotive types ever to run on British railways. Mr. Hambleton's infectious enthusiasm pervades the whole book, and we shall be surprised if it does not stir up a large number of "Oliver Twists" who will ask for more!

The Midland Johnson single-wheelers, the S.E. & C.R. Stirling 4-4-0's, the L.B. & S.C.R. "Gladstone" class, the L.N.W.R. 2-4-0's, the Webb compounds, the G.N.R. Stirling eight-footers and the L. & Y.R. Aspinall 4-4-0's are only a few of the good things to be found in this book, and all of these are decidedly worth modelling. But there are many others besides, a few of them appearing more or less incidentally in one or two of the chapters.

The drawings are well reproduced, and those which are not dimensioned in detail carry a scale of feet and inches so that they can be used for any size of model.

Tenders for "Maid of Kent" and "Minx"

by "L.B.S.C."

NOW we come to the tenders for the two 5-in. gauge engines; and those followers of these notes who have completed the engine part, will find the tender as easy a job as eating a piece of cake. An outline of the type of tender used with the Southern "L1" class engines, is shown here; and all being well, the outline of a "regulation" Vulcan tender, as used by the "Minx's" big sisters, will appear next week. One point about both tenders which will appeal to builders and drivers of these little engines, is that they are low-sided, and do not obstruct the footplate of the engine. A tender as high as the cab roof, carrying enough coal and water for a non-stop run from Tottenham-court-road-street to Timbuctoo, is all right in 4-ft. 8½-in. gauge, but a confounded nuisance in 5 in., and as the full-size tenders are low-sided, we shan't offend our old friend Inspector Meticulous! Incidentally, the Vulcan tender is much simpler, as regards the frame, axleboxes and springs, than the "L1" tender, as you'll see next week; so anybody who doesn't care a bean what the beforementioned Inspector thinks, says, or does, can use a "Minx" tender behind a "Maid," or put the bodywork of a "Maid" tender on a "Minx" chassis, or any other thing he pleases. The tenders are interchangeable, anyway, and the blobs and gadgets inside the tank are exactly the same. This, by the way, will save having to give two lots of illustrations, and two descriptions, for the "innards."

Frame Assembly for "Maid"

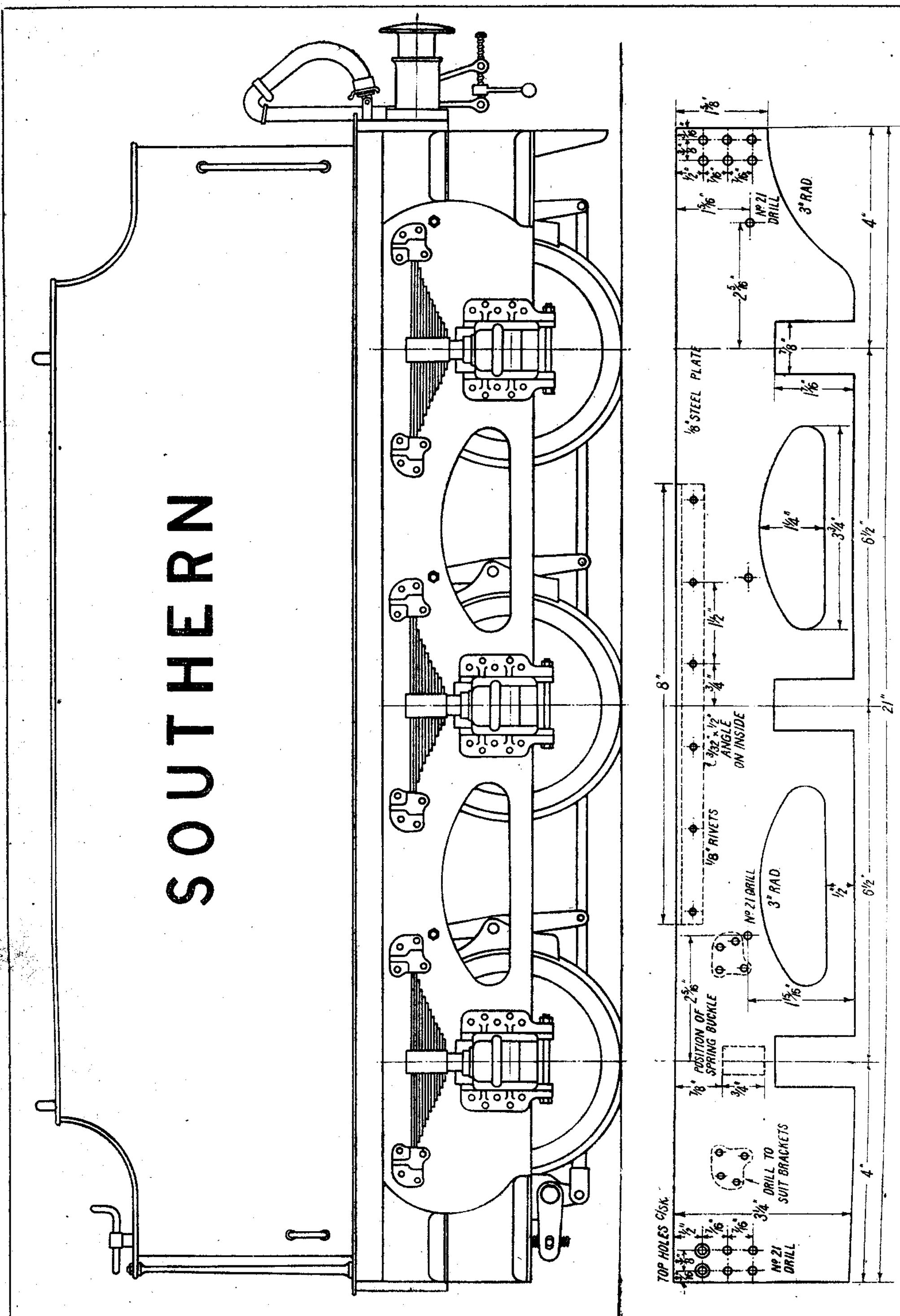
Two pieces of ⅛-in. soft blue steel, 21 in. long and 3¼ in. wide, will be needed for the "Maid's" tender frames; mark one out, drill a couple of the screwholes, rivet together, and cut them out same as you did the engine frames. Not much need for me to elaborate on *that* job! Beginners might be reminded that if holes are drilled all around inside the marked-out openings in the frame between the wheels, the pieces can easily be broken out, and the resulting big holes finished with a half-round file. Alternatively, you can drill just one hole, put an "Abrafile" through it, and cut away the unwanted metal with that; but be careful to keep on the proper side of the marked line when you go round the corners. Before parting the frames, mark which is the outside. On what will be the inside, midway between the ends, and level with the top, rivet to each frame an 8-in. length of ½-in. by 3/32-in. angle; brass or steel will do. Use ⅛-in. rivets at 1½ in. centres, as shown. This is to form an attachment for the middle part of the soleplate, and renders cross staying unnecessary.

The buffer- and drag-beams can be made from 9-in. lengths of 1⅝-in. by 1-in. by $\frac{3}{16}$-in. angle, or castings can be used. In either case, the machining and fitting is exactly the same as described for the engine, so there is no need for repetition. In the plan drawing of the frame assembly, one end of the beam is shown secured to the frames by pieces of angle, screws, and rivets; but for my own part I prefer to braze up the lot solid. However, there is a wasp in the jampot here, inasmuch as whilst it is child's-play to braze or Sifbronze the frames into the slotted beams with an oxy-acetylene blowpipe (actually easier than soft-soldering—at least, I find it so) it isn't so easy with a blowlamp, as the big beams take a lot of heating up. Maybe in this case, the angles, screws and rivets are to be preferred. Whatever else you do, make quite certain that the frames are perfectly parallel, also square with the beams, before finally screwing up; test on lathe bed, or something else equally flat and true, as previously described.

Horns, Springs, and Axleboxes

Some folk may prefer to fit the horncheeks before erecting the frames; well, that is a matter you can best settle to your own inclination. In any case, castings will be supplied for the horncheeks, and they should be milled on both the bolting and sliding faces. This is easily done with an end-mill in the three-jaw, and the casting held by the toolholder on top of the slide-rest; if you have a vertical slide, bolt a small machine-vice to it, and hold each horncheek in that. Lucky owners of milling-machines need only clamp the horncheeks in a machine-vice on the miller table, and traverse them under a cutter on the arbor. If you haven't one wide enough to do the job in one cut, take two or three, but take care not to alter the height of the table. A planer or shaper can also be used, with the work in the machine-vice and a round-nose tool in the clapper-box. This job should *not* be done by hand filing; use the lathe, as first mentioned, if nothing else is available, as the surfaces must be perfectly true and flat, and at right-angles. Use a bit of ⅞-in. flat or square rod as a jig, when setting the horncheeks to the slots in the frame.

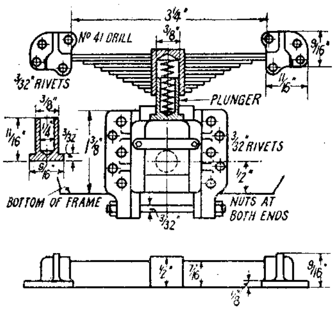
Cast dummy springs may be used, with a spring-loaded plunger or buffer sliding in the buckle or hoop; or anybody who likes to take the trouble, can make real working leaf springs. A nobby way to use up your worn or broken hacksaw blades! On the "Maid," there are no spring-hangers, each end of the spring being held and supported by a casting, which transmits the weight of the tender direct to the ends of the springs. Cast dummy springs will have these brackets all in one piece with the spring; but separate cast brackets will be needed if the springs are built up from steel plates. The drawing shows the shape and position of the brackets, which may either be riveted or screwed to the tender frame, whichever you prefer. Note, there is no obligation to fit this particular type of spring



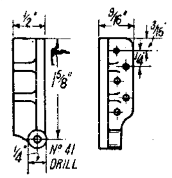
Tender for "Maid of Kent," and details of frames

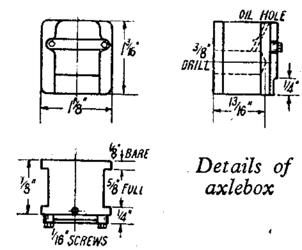
and bracket ; the usual type with drop-hangers will serve just as well, the only stipulation being that the spring buckle, or hoop, as it is known among the spring-manufacturing fraternity, shall be in the position indicated by the dotted lines. The buckle is drilled $\frac{3}{8}$ in. to take the plunger or buffer that houses the working spiral spring. These plungers are turned up from $\frac{9}{16}$-in., or nearest available brass rod, or from a cast stick, held in the three-jaw. The plunger should be an easy sliding fit in the holes in the buckles or

Our advertisers will probably supply the set of axleboxes cast in a stick ; and as the machining and fitting of these, is precisely the same as for the engine axleboxes, again no repetition should be necessary. However, unlike the main axleboxes, the holes for the journals are drilled " blind " ; use $\frac{3}{8}$-in. drill, and go to a depth of $\frac{13}{16}$ in. only. Don't forget the little $\frac{1}{16}$-in. oil-hole leading from the top of each axlebox to the blind end of the journal hole. The axleboxes should be a fairly easy fit in the horncheeks,

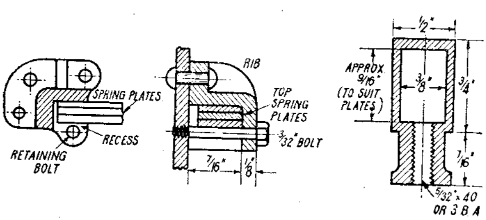


Axleboxes and springs

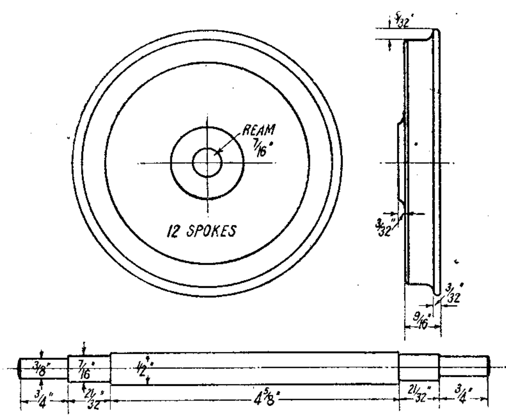




Details of axlebox



Brackets and hoop for working leaf springs



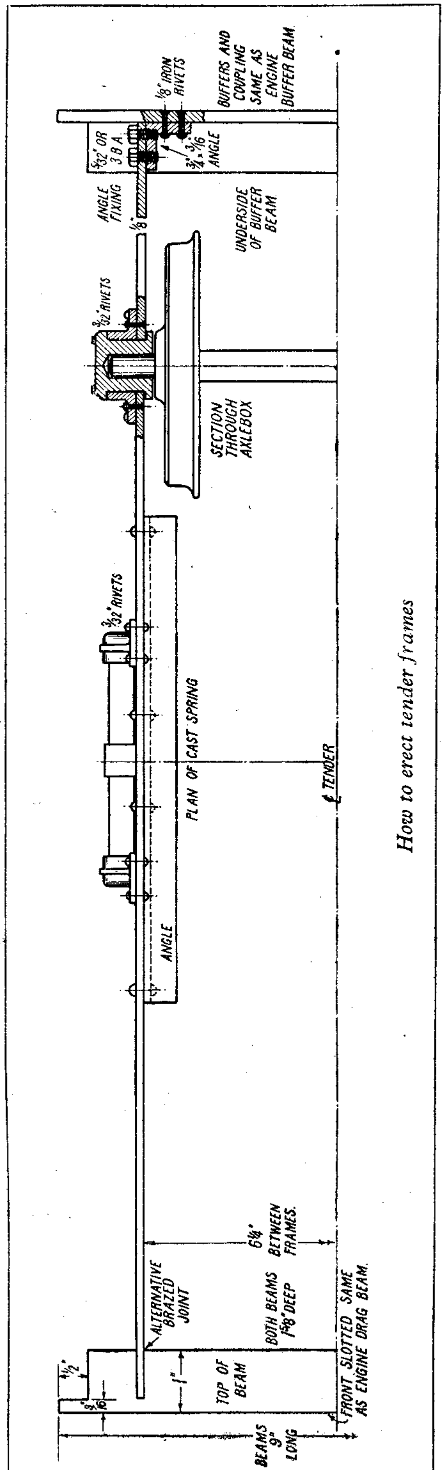
Wheels and axles

hoops. The springs should be fairly stiff, and wound up from 18-gauge steel wire. Maybe our advertisers will supply ready-wound springs.

There is no difficulty about making the real working leaf springs if same are preferred. Thin broken hacksaw blades, or pieces of the strip steel used for clock springs, $\frac{3}{8}$ in. wide and about 22- to 26-gauge, can be used for the plates ; the hoop can be made from a $1\frac{1}{4}$ in. length of $\frac{1}{2}$-in. square steel, the hole for the plates being drilled $\frac{3}{8}$ in. and then filed out to a rectangle. It is then chucked in the four-jaw, faced off at the end where the hole is, reversed in chuck, and the other end turned down to the shape shown in the detail sketch, the lower part being exactly the same shape as the end of the plunger which projects from the bottom of the cast dummy spring, and rests on the axlebox. It should be a full $\frac{3}{4}$ in. long. Drill and tap a 5/32-in. by 40, or 3-B.A. hole in the bottom, extending into the rectangular hole, and put a grub-screw in this, to hold the nest of plates. An Allen screw would be just the ticket for this job.

and should also have enough clearance between the flanges, to allow for a slight tilt when running over an uneven road. Incidentally, those good folk who are responsible for the construction of club tracks, and go in for concrete arches and posts, or other forms of construction that form a solid foundation for the permanent way, are very wise. I know of several " all-wood " lines that are unsafe to run on, at a fair speed, owing to twist, winding, and distortion. Wood posts and longitudinals serve well enough for a back-garden line where the owner is practically the only one who uses it, and can give it the attention needed to keep it in good order ; but a club track which has to withstand heavy traffic, is a different proposition. I refer, naturally, to the permanent-fixture outdoor line, and not the portable kind used at indoor club meetings, or taken out to fetes and other temporary functions.

Axleboxes can also be made from bar material of $\frac{7}{8}$-in. by $1\frac{1}{8}$-in. section. A piece $3\frac{3}{4}$ in. long, can have the grooves milled in each side of it, same as described for main axleboxes ; and this



How to erect tender frames

can be cut into three, and the ends faced off, making the set of axleboxes for one side. The ornamental lid, or front, can be filed up from $\frac{1}{8}$-in. sheet brass, and attached by two $\frac{1}{16}$-in. hexagon-head screws, as shown in the detail drawing of the axlebox. The bottom lugs on the horncheeks are drilled No. 40, the hornstays being 2-in. lengths of 3/32-in. silver-steel, screwed and nutted at both ends.

Wheels and Axles

The wheels and axles are the same for both "Maid" and "Minx." The wheels are 4 in. diameter on tread, the treads and flanges being turned to the same width and profile as given for the engine wheels, and shown in the reproduced drawing. The bosses stand out a little farther, owing to the axleboxes being outside the wheels. The axles are turned from $\frac{1}{2}$-in. mild-steel. If your lathe has a hollow mandrel which will take this size of rod, and the chuck is reasonably true, the axle blanks can be held in the three-jaw, and the wheel seats and journals turned at one fell swoop; they can't help being anything else but true with each other, in that case. If you only have a solid-mandrel lathe, or one with a small hole through it, the axles will have to be turned between centres; and if $\frac{1}{2}$-in. rod is used, it will have to be carefully centred to prevent it running all wibbly-wobbly when the wheels are pressed on. The best thing for beginners or inexperienced turners to do, would be to use $\frac{9}{16}$-in. or even $\frac{5}{8}$-in. rod, and turn the whole length. If the larger size is used, it doesn't matter a bean about turning the middle part down to $\frac{1}{2}$ in. diameter; just take enough off it, to enable it to run truly.

Well, I guess you've got more drawings than instructions this week; but as I said before, it is only a waste of time and space detailing out again jobs for which full instructions were given when describing the construction of the engine part. I give all followers of these notes full credit for not forgetting their "lessons," and even if they *are* slightly forgetful, they can always turn up their back numbers for refreshing their memories. There is no need to drag out the "serial stories" any longer than absolutely necessary. Next week, all being well, similar drawings will appear for the tender for the "Minx." Builders of this engine who are keeping up with the notes, can carry on with their tender wheels and axles as described above.

True to Life!

A strange coincidence has presented itself in connection with my little L.B. & S.C.R. single-wheeler "Grosvenor." She is, at long last, very nearly completed—by the time these notes appear, she may be quite finished—and has made a number of very fine runs. I duly set the valves under steam, though I could not get the four beats *exactly* even in next notch to middle; the reason being, the departure I made from full-size practice in the valve gear, by putting the weighbar shaft underneath. The lifting-links being short, the upper ends of them describe an appreciable arc as the links oscillate, and cause

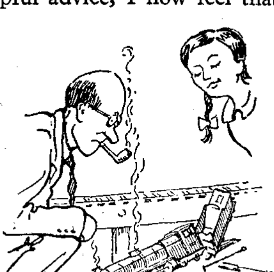
(*Continued on page* 542)

YOUTHFUL ENTERPRISE

Tales of a Tyro

by Edward Adams

THE first 2½-in. gauge locomotive I made was from the blueprints of "Uranus" 4-8-4, which, because of my inexperience, was some years in the making. Notwithstanding frequent calls for help to "L.B.S.C.", always met by courteous and helpful advice, I now feel that it really was far too ambitious a task for a mere novice and I can, in retrospect, apply to myself the saying that "Fools rush in where angels fear to tread."


"DIDN'T IT GO FAST DADDY?"

However, in due course it was finished and named "Michael" after young Edward Michael who, in a measure, grew up with it and early mastered the elements of driving.

Once, being left with his namesake in steam, he improved the shining hour by giving rides to passing children on our first track, a short up-and-downer. Seven trips for a halfpenny was his levy and he had actually pocketed fivepence before being discovered by scandalised parents, the last copper or two being earned by pushing the truck, steam having died down. But why seven trips nobody knew.

Children seem to like the excitement of speed and have more than once prevailed upon me against my better judgment to "see how fast she will go" with dire results. I wonder how many fathers have fallen for this insidious temptation! Repentance at long leisure is likely to follow, doing major repairs in the workshop.

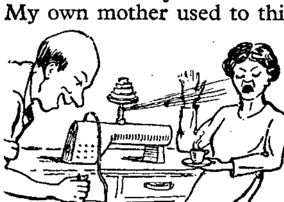
Invitations to stage a crash, however, have so far been coldly received. On the whole, accidents on our line have been rare; at long intervals, a water-gauge glass cracks and bursts, filling the garden with steam. When this has happened, I have seen children fall on their backs on the lawn in their haste to escape, running backwards so as to keep the engine in view. Alarming perhaps, but harmless, like a pop safety-valve going off, which never fails to make us jump, even when it is expected.

Long-suffering wives and mothers, if not fully understanding our problems, do nevertheless sympathise with our difficulties, as when a boiler leaks or the blowlamp refuses to function; they render first-aid on our cuts and bruises and provide the opportune cup of tea.

I once applied the water test to a boiler, using a weighted plunger for release-valve. My good lady appeared with a hot drink at the exact moment when the weights decided to rise and a powerful jet of water from the escape hole was directed precisely in her face; purely coincidence, of course, but difficult to explain away! Useless to invite her to admire and wonder at the efficiency of "L.B.S.C.'s" famous design for the tender pump.

Odd-shaped and heavy parcels arriving by post excite the feminine curiosity, only to disclose uninteresting metal rods, castings or screws, when they might so well have been books or even boxes of chocolates.

Owing to familiarity with household gadgets and wartime exercises, the modern miss is more mechanically-minded than the last generation for whom machinery was essentially a man's interest. My own mother used to think that a locomotive had to be carefully steered around curves by the driver, with possibly some assistance from the stoker, regarding them as highly skilled and responsible individuals, on whom our lives and safety depended.


WATER TEST

Judging by myself, I should say that modellers are particularly sensitive to being laughed at. In time, however, one grows a thicker skin, so that to be referred to as "that fellow Adams who makes toys rather well" no longer annoys, but rather amuses one.

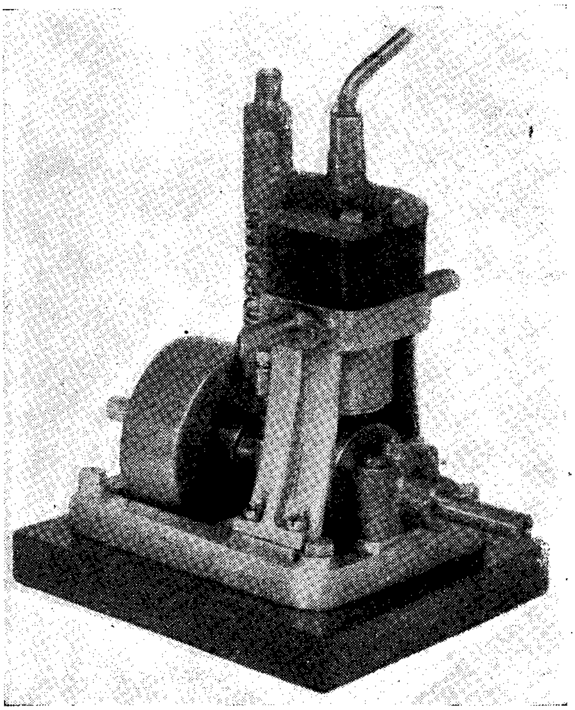
I remember with gratitude the encouraging remark made to me by a Director of Education who was to introduce me to an assembly for a talk on small locomotives. I expected to be confronted by the usual audience of small boys and was dismayed to find a room full of school teachers, very old boys some of them. "Never mind, Adams," said he, "I've got a railway in the attic."


"I'VE GOT A RAILWAY IN THE ATTIC"

*UTILITY STEAM ENGINES

by Edgar T. Westbury

THE crankshaft for the "Spartan" engine may be made either from the solid or fabricated by brazing. As shown in the drawing, it consists of two parts, one being a fairly orthodox overhung crank and the other a loose follower. Some constructors may prefer to dispense with the follower, in cases where it is not desired to fit auxiliaries such as feed and oil pumps, or where other provision is made for doing so. In this event, not only the follower, but also its bearing, may be omitted; the reduced end of the crankshaft is then fitted with a retaining collar, pinned or nutted in place.



A view of the "Spartan" engine from the auxiliary drive shaft end

The machining of overhung crankshafts has been described many times in THE MODEL ENGINEER and need hardly be dealt with in detail here. It may be said that any method of machining which will ensure true parallel alignment of the crankpin with the main axis, and reasonable accuracy of throw radius, is perfectly sound, but on the strength of experience in making these shafts, I favour the use of some form of eccentric jig for turning the crankpin, and the same device can be used to ensure accurate location of the hole in the follower flange for engaging the crankpin. The eccentric turning should be done before finishing the journals to size, the latter being left well oversize, but parallel, and to a definite dimension; both the main shaft and the follower being identical in this respect, to ensure the radius of the crankpin and the engaging hole to be the same in each case. Afterwards, the turning of each shaft is completed by remounting it between main centres.

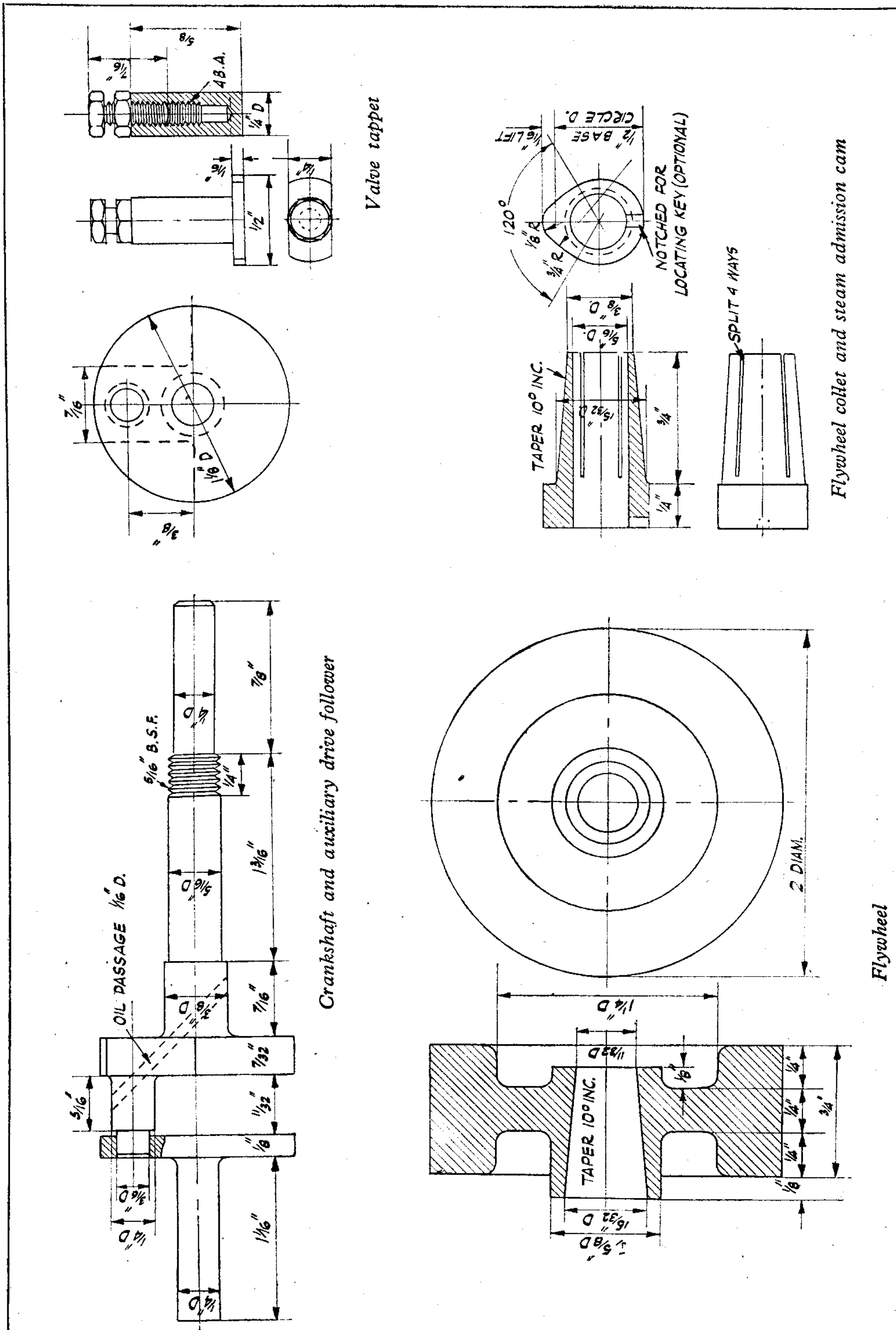
The journal surfaces should be accurate to size and highly finished, and the same applies to the seating for the flywheel collet. Either screwcutting methods, or a tailstock dieholder, should be used to ensure that the thread for the flywheel nut is as accurate as possible. The web of the crankshaft is cut away to form a balance weight, but this is not necessary in the case of the follower shaft, and should on no account be done if there is any slack in the engagement of this shaft with the crankpin, as it may result in violent hammering.

Flywheel

Cast-iron or gunmetal is equally suitable for this part, and in machining it, the essential thing is to ensure that all parts are perfectly concentric. Methods of procedure have already been recommended, and it should not be necessary to repeat them. The flywheel is of more than ordinary importance in the case of a Uniflow engine, as explained in the preliminary comments on this form of design; it is heavier than usual, and mounted between the main bearings instead of on the end of the shaft, for adequate support and steadiness of running. The bore of the flywheel is tapered for mounting on the collet, and the internal surface should be true and smooth, though the actual angle is not critical. True running of the flywheel does not necessarily ensure its perfect balance, as the casting may not be perfectly homogeneous, so it is advisable to check up by mounting the flywheel on a mandrel and testing on knife-edges, correcting the balance if and where necessary, by machining locally on the inside of the rim.

It will be seen that the flywheel collet is integral with the cam which operates the poppet valve, and

*Continued from page 477, "M.E.," April 21, 1949.



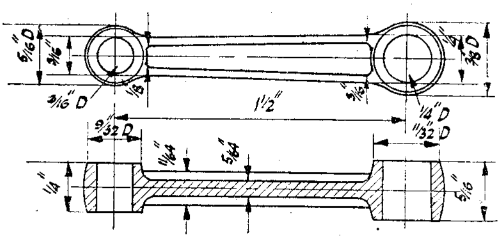
Valve tappet

Flywheel collet and steam admission cam

Crankshaft and auxiliary drive follower

Flywheel

as the collet is not positively keyed to the shaft, this enables the cam to be "timed" in the best position for producing maximum power under the particular running conditions. The cam position may, however, be fixed definitely when once this timing has been found. The collet is made of mild-steel, and may be machined all over at one setting by allowing sufficient length of stock for chucking. Special care should be taken to machine the taper to fit that of the flywheel,



Connecting-rod

and the use of marking blue or similar pigment will be found helpful in showing up high spots when the parts are mated. It is permissible to use a dead smooth file for ensuring perfect contact throughout the full length of taper, after the surface has been turned as accurately as possible, but don't try "grinding in." The bore of the collet should be a tight push fit on the shaft.

Before parting-off the collet, the latter may be held by the chucking-piece in the lathe tool-post for slitting with a circular saw. Remove the burrs from the bore after this operation. The machining of cam contours has been described in THE MODEL ENGINEER on several occasions, and this cam is designed so that the eccentric turning methods used in producing the cams for the "1831," "Seal," and other petrol engines may be used, but nothing very elaborate in the way of a turning jig is necessary in this particular case. It is, however, quite permissible to file the cam to the shape shown, using templates or radius gauges to ensure that the proper arcs for the nose and flanks are obtained. The base circle should be exactly concentric with the bore, and this may be ensured by "planing" this part of the surface with a tool held on its side in the lathe tool-post—the collet being held truly in the chuck or on a mandrel meanwhile—or by a circular milling operation.

If it is intended to key the collet in place eventually, a notch may be made in the end face of the cam, approximately opposite to the lobe, and $\frac{1}{16}$ in. wide by $\frac{1}{16}$ in. deep, to take a pin or "snug key," the seating for which can be located and drilled while the engine is fully assembled. The cam end of the collet should finally be case-hardened and polished

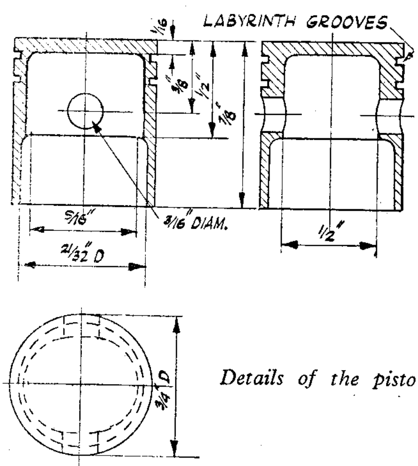
Tappet

The form of cam shown is designed to work in conjunction with a flat-ended or "mushroom" follower, but the foot in this case is cut away at the sides, to save room and also to key it against rotation. It may be turned from $\frac{1}{2}$-in. diameter mild-steel, drilled concentrically and tapped for the adjusting screw, then parted off and faced on the foot. After flattening the sides, the tappet is case-hardened and polished, which should be done with the screw and lock-nut screwed right home, so as to harden the head and hexagon faces, but not the internal or external threads of either part.

Connecting-rod

A bronze casting is supplied for this component, and this has been found quite suitable for working at quite high speed, besides being good from the aspect of bearing wear; but it is always an advantage to use as light a rod as possible, and in this respect, many constructors may prefer to machine the rod from solid duralumin or other high-tensile light alloy. Despite its lower weight, this material is stronger than most kinds of cast bronze, and it wears quite well as a bearing metal if kept well lubricated. The procedure for machining a connecting-rod from the solid has been described in THE MODEL ENGINEER on several occasions, in connection with small i.c. engine construction.

Whether the rod is cast or made from the solid, however, the essential point in machining the bearing eyes is that they should be exactly parallel in both planes. I have described methods of ensuring this, one of the simplest in my experience being to clamp the rod in any convenient manner to a piece of flat steel bar, which is in turn mounted on the faceplate, and the entire



Details of the piston

assembly is then shifted bodily to bring the centre of each eye, in turn, into line with the lathe axis for drilling and boring. Provided that the fixing of the rod to the bar is secure, and that it is not moved thereon between operations on the two eyes, it is obvious that the latter must be perfectly parallel when bored. A reamer or D-bit may be used for finishing the bores.

In the event of the rod being made from the solid, some readers may prefer to make it of circular section, so that it can be turned between centres, in which case the ends may be turned spherical. This leaves more metal on them than is desirable for extreme lightness, but it may be reduced by turning some of it away when boring

the eyes, and filing round the centres of the bosses. The eyes may be set up on pin mandrels for turning and facing the ends of the bosses not accessible at the initial setting.

Side alignment of the eyes is not critical, as the little ends have plenty of end play, but it should be kept fairly close, to preserve symmetry and avoid offset thrusts, which would have a tendency to bend the rod, or at any rate cause uneven bearing wear.

Circular section rods may, if desired, be drilled longitudinally, which not only reduces weight but also provides a passage for lubricating oil. With unbushed eyes, however, it is not desirable to drill too large a passage, as this reduces the area of bearing surface on the most heavily loaded side of the bearing; and internal oil passages of this nature are open to the objection that they can only introduce the oil to the bearing at the point of highest pressure. This might be avoided by fitting annular-grooved bushes to the eyes, but the extra bulk and weight thus involved is undesirable in high-speed engines. The entry hole of the passage, through the outside of one of the eyes, should be plugged. Note that the lubrication problem in a steam engine of this type is much more difficult than that of an i.c. engine, especially a two-stroke, which is continually bathed with a saturated oil mist; and enclosure of the crankcase is not an unqualified advantage in a steam engine, owing to the amount of condensate which always finds its way past the piston. While an emulsion of oil and water is by no means a bad lubricant for moderately loaded bearings, it is not reliable when the bearing pressure is very high, and every effort should be made to ensure that undiluted oil reaches the important bearings of a high-speed engine of any kind.

Piston

It is recommended that this should be made of cast-iron, lightened as much as possible by internal machining. The use of piston rings is optional, but as accurate rings of $\frac{3}{4}$ in. diameter are difficult to make or obtain, I have shown a plain piston with labyrinth grooves which help to maintain the steam seal by trapping oil and water. Soft packing is not very satisfactory in high-speed engines, and would be quite impracticable in a Uniflow engine, as it would escape into the ports and get torn to shreds very quickly.

Light alloy pistons, fitted with rings, have been used with success in some high-performance steam engines, and they obviously enable piston weight to be reduced; but it is essential to use heat-resisting alloys (such as Y-alloy), because the temperature attained when using superheated steam may easily approach the point at which ordinary alloys, including duralumin, lose much of their mechanical strength.

The pistons may be machined from bar material at one setting by methods which have been described for i.c. engine pistons (a good example may be found in the case of the "Craftsman Twin" engine described during last year). It may be noted that only very shallow gudgeon pin bosses are used in the pistons now under discussion, and as an alternative to milling the inside of the piston, these may be formed by setting over the casting slightly in the chuck, in a plane at right-angles to the gudgeon pin, and eccentric boring away the superfluous metal on both sides. This should preferably be done after boring the cross hole for the gudgeon pin, which again is carried out by methods described for i.c. engines. In this way the location of the internal piston bosses is easily seen.

I may perhaps be accused of vain repetition, in repeatedly stressing the importance of the piston fit in all high-speed engines, but I will again emphasise how much it counts in promoting efficiency and long wear. The piston should be made well on the tight side—it is worth while to turn a dummy piston first to serve as a gauge—and carefully lapped with a ring lap before parting off from the chucking piece. Light alloy pistons will, of course, require more clearance than cast-iron, but even in this case, and allowing for the use of piston rings, the clearance should never be excessive.

(To be continued)

"L.B.S.C."

(*Continued from page* 537)

the expansion links to bob up and down just sufficiently to throw the engine very slightly off beat when the die-blocks are as near to the middle "as makes no odds." In all the other notches she is all right; the slight unevenness, however, does not affect her running in any way. Incidentally, this "I-*think*-I-can" effect was not exactly unknown among her big sisters!

When hauling my weight, she has a load equivalent to approximately 320 tons behind the tender; a far greater load than the full-sized engines were ever intended to pull. On a recent fine afternoon, needing a breath of fresh air, I steamed her up, and made the equivalent of a non-stop run from Victoria to Eastbourne. The injector was not used during the trip, the crosshead pump keeping the water-level maintained with the by-pass slightly open. I started with a full tender of water, and the pile of coal was just about equivalent to what the full-size tender would have carried. She made a faultless run, gliding over the rails at an equivalent "ninety" with an almost inaudible blast; and when we reached the end of the journey—lo and behold! there was just about as much coal and water left, as there would have been on her big sister after a similar trip! True, she pulled a bigger equivalent load, but the superheater and mechanical lubrication cancelled that out. She is a proper "chip off the old block."

*Constructing a Gear-Cutting Machine

by J. S. Eley

AN iron casting is used for the rotating sleeve and should be chucked for facing, boring and turning the outside as far as the chuck jaws will allow. A close sliding fit over the boss should be aimed at. The sleeve is now reversed in the chuck and set to run truly for facing the other end and finishing the outside. The length of the sleeve should be two or three thou. less than the length of the boss. The milling of the flat as a seating for the worm bracket can be left for a moment as its depth will depend on the size of the worm and worm-wheel being used. Its position can be marked, however, and diametrically opposite to it a line is scribed to mark the position of the saw cut for splitting the sleeve. Before splitting, however, the tap and clear holes for the clamping bolt should be drilled. In order to start the drill and also provide a seating for the head of the clamping bolt it will be necessary to mill into the side of the sleeve with an end-mill. The type of end-mill having multiple cutting edges on both end and side should be used for this operation. When drilling, the tapping size drill is run right through first of all. This is then followed up by the clearance drill for a little over half-way. The sleeve can now be split and the neatest way is again by running a circular slitting saw through the wall of the sleeve on the scribed line into the bore. The most convenient type of clamping bolt is an Allen socket-head screw.

Spindle. M.S.

A piece of 2-in. round mild-steel bar can be cut to length for this part. The first operation is to chuck the blank and rough down the journal portion to within 1/32 in. of size. This is now reversed in the chuck and the spindle bore drilled through slightly undersize. A slender boring tool is now used to correct any wandering of the drill and the final size and finish obtained by means of a reamer. The flange is next faced and turned on the periphery. The mouth of the bore is now opened out to accommodate the draw-in centre or alternatively, draw-in collets. The actual dimensions of the taper will, of course, depend on the type of collet used. In my own case, centres and collets from a small precision lathe have been utilised and the same collets are also used in the bevel gear attachment which will be described at a later stage. Of course, if desired, the draw-in feature can be dispensed with and the spindle bored No. 1 Morse to receive standard centres. Whichever method is adopted, however, great care should be taken over the mating of the tapers. The most practical way is by trial and error, using marking blue to ascertain when a good fit has been obtained. It is essential, of course, to have the point of the boring tool exactly at centre height. This completed, the work is removed from the chuck and mounted on a true running mandrel for finishing the journal to size. At this setting, the shoulder of the flange is also machined up and the journal faced off to length.

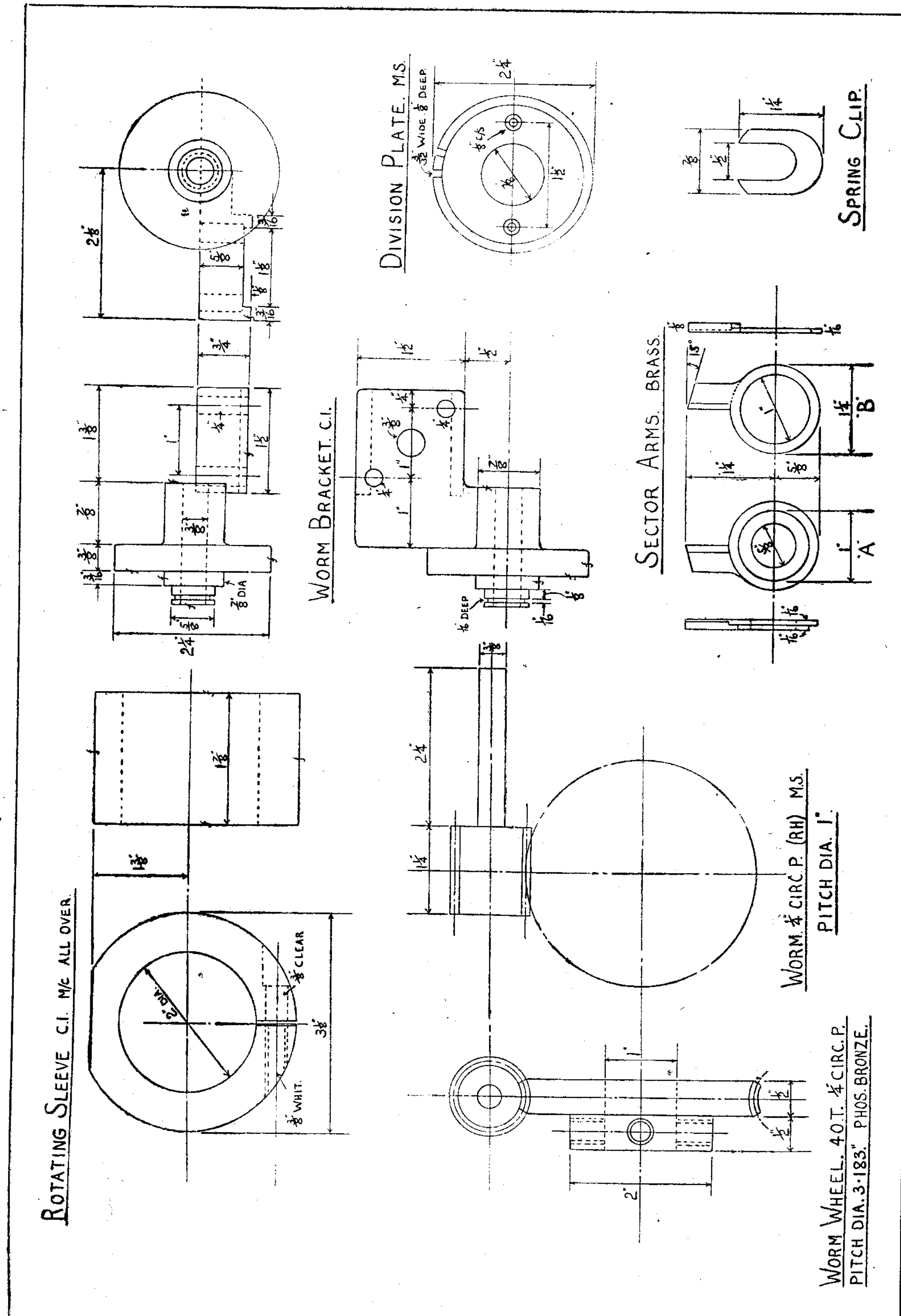
Worm and Worm-wheel

These two items were the only parts bought ready made in the original machine. Dimensions are given, however, and it is quite feasible to screw-cut the worm in the lathe, making an extra length of worm for use as a hob. This process of hobbing worm-wheels has been dealt with at length several times in THE MODEL ENGINEER, and so I will not elaborate on this point. One thing regarding the securing of the worm-wheel to the spindle needs mentioning however. Four Allen screws are used for this purpose and dimples are spotted through on to the spindle. These dimples, however, are offset from the original markings. If numbered consecutively 1, 2, 3 and 4, Nos. 1 and 3 are offset to the left and Nos. 2 and 4 offset to the right. Thus by slackening one pair of screws and tightening the other pair, a degree of lateral adjustment is obtained which can be used to eliminate all end-play in the spindle. This dodge can also be used on any collars for taking up end-play on other parts of the machine.

Worm Bracket. C.I.

This part has two narrow pads for seating it on the rotating sleeve and these should first of all be trued up by filing—machining is hardly necessary. The casting is now clamped on these pads to an angleplate mounted on the lathe faceplate, and the circular seating for the division plates set to run truly. The face of this seating is machined and also the outer edge turned down to size. On the drawing, the central boss with its annular groove for the spring clip, is shown solid with the rest of the casting, but owing to the sections being reduced to a size smaller than is usually advisable in cast iron, it will be found more satisfactory to make the boss in steel and press it in. Having machined the circular seating, the bearing for the worm shaft is now drilled and reamed and also the counterboring done to receive the steel boss. The other end of the worm shaft housing can be faced up with a spot facing cutter or the casting swung again in the lathe on a stub mandrel. It now only remains to drill and tap the various holes shown in the drawing. At this stage, if a worm and wheel have been made or otherwise procured, the parts so far machined can be assembled. First, however, a flat must be machined on the rotating sleeve for mounting the worm bracket. This can be milled off or turned off in the lathe gripping the sleeve crosswise in the four-jaw chuck. Dimensions for this are not given, as this depends on the worm and wheel

**Continued from page* 519, "*M.E.*," *April* 28, 1949.


ROTATING SLEEVE C.I. M/C ALL OVER.
WORM BRACKET. C.I.
DIVISION PLATE. M.S.
SECTOR ARMS. BRASS
SPRING CLIP.
WORM. ¼" CIRC. P. (RH) M.S.
PITCH DIA. 1"
WORM WHEEL. 40 T. ¼" CIRC. P.
PITCH DIA. 3·183" PHOS. BRONZE.

being used. Sufficient metal should be removed however, so that when the worm bracket is seated down on the flat, the worm and wheel are only loosely meshed. Tap holes are now spotted on to the flat through the clearance holes in the worm bracket and the two parts bolted together. Finally, by careful filing of the two seating pads on the worm bracket, the worm and wheel are brought into full mesh and all backlash eliminated.

Division Plates. M.S.

These are circular steel plates $2\frac{1}{4}$ in. diameter and $\frac{3}{16}$ in. thick. Instead of the usual holes, rectangular notches are cut around their outer edges. This is to enable them to be cut without difficulty on a milling machine or in the lathe after the fashion of a gear wheel. This, of course, means that only one series of divisions is possible for each plate, but in any case it would not be possible to get many series on one plate even if the more orthodox holes were used, as the diameter of the plate is limited to $2\frac{1}{4}$ in. in order to clear when the dividing head is rotated.

As a matter of fact, I have only made four plates to date, having 20, 21, 24 and 27 notches respectively and these have given all the divisions I have required so far.

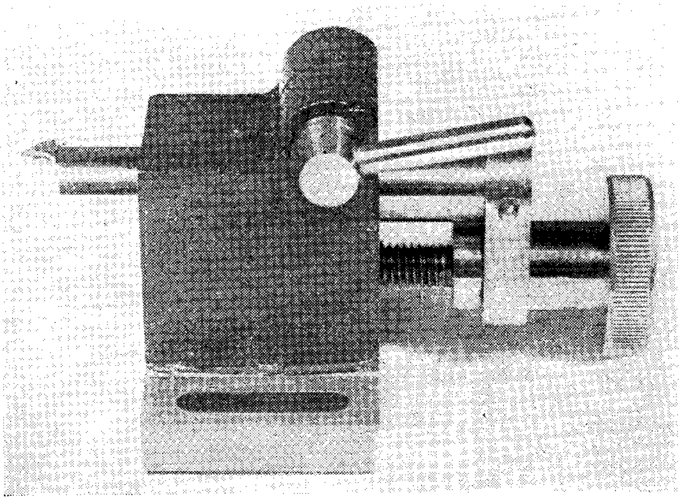
The notches are cut with a circular slitting saw 3/32 in. thick to a depth of $\frac{1}{8}$ in. To secure the plates two $\frac{1}{8}$-in. countersunk holes are drilled where shown and tap holes spotted through on to the circular seating of the worm bracket.

Sector Arms and Rings

The two halves are each made from $1\frac{1}{4}$-in. × $\frac{1}{8}$-in. flat brass bar. For each part a 2 in. length of bar is sawn off and the bore centre marked out and centre popped. Taking part "A" first, the bore is marked out with dividers and also the annular groove in which the ring of part "B" fits. The blank is now chucked squarely in the four-jaw and set to run truly to the scribed circles. The bore is first drilled out and bored to size to be an easy fit over the boss of the worm bracket. To machine the groove, a parting tool is used, ground away to provide clearance on both sides and the groove machined out $\frac{1}{16}$ in. deep by a trepanning operation. The outer edge of the ring cannot be turned owing to the sector arm, and so must be filed down concentric with the groove. Part "B" is treated similarly, only the bore is made a snug fit over the boss formed on part "A" and the ring portion correspondingly mated to its groove. The ring is also thinned down to $\frac{1}{16}$ in. by turning, so that when the two halves are fitted together, the total thickness is still only $\frac{1}{8}$ in. Again, the outer edge of the ring must be finished by hand. Both sector arms are now sawn and filed to shape. The two halves are locked together in any required position by a small set-screw tapped into the boss of part "A" and having a small washer overlapping the ring of part "B." The spring clip for holding the sector arms in position is made from thin springy steel and filed or ground to the shape shown.

Index Arm and Plunger. M.S.

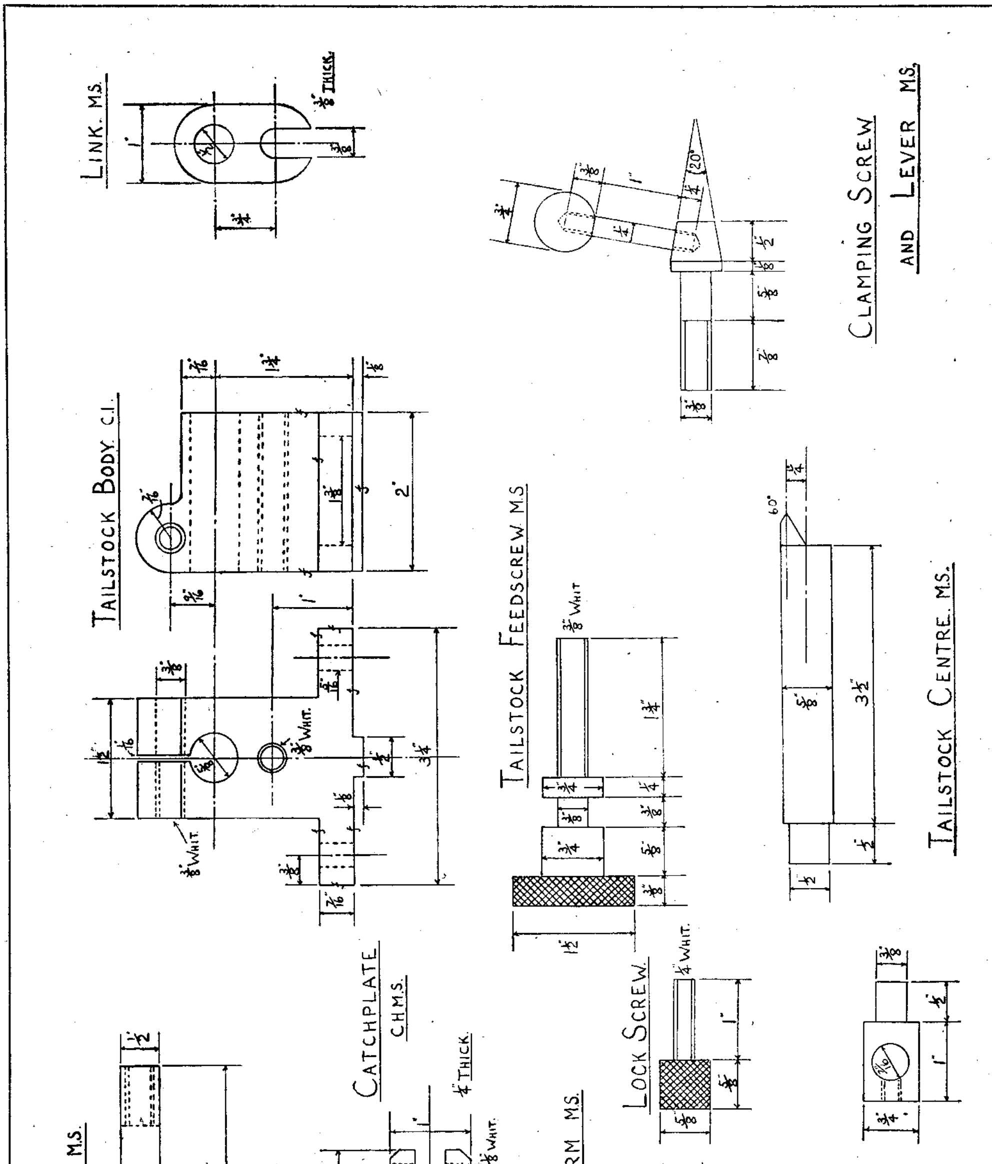
The index arm is a simple piece made from $\frac{3}{4}$ in. × $\frac{1}{2}$ in. B.D.M.S. The centres of the two holes are first marked out and the radius at each end scribed from the centre-pops. Two lines scribed tangentially between the two radii form the tapered flanks. After drilling, each radius is filed either by hand or by using filing buttons, the flanks being filed and finally finished off on the side of a grinding wheel. The plunger has a knurled head while the tip is filed to a gentle taper so that it will wedge tightly in the division plate notches. The tip is finally case-hardened. When fitting the plunger to the arm a flat should be filed on the shank so that a peg fitted to the arm will prevent the plunger from turning or falling out. The arm is finally secured to the worm shaft by means of a taper pin.



The completed tailstock

Driving Plate. M.S.

This part is made from 1 in. × $\frac{1}{4}$ in. flat steel bar and is quite straightforward. It is secured to the dividing-head spindle by two $\frac{3}{16}$-in. Whitworth countersunk screws. I have always regarded the usual method of driving mandrels from a driving plate via a carrier with a bent tang as unsatisfactory. It usually happens that a carrier of exactly the right size is not available and also the gripping of the tang by the driving plate screws leaves much to be desired and to get a solid drive usually means overstraining of screws and other undesirable remedies. To


LINK. M.S.
TAILSTOCK BODY. C.I.
CLAMPING SCREW AND LEVER M.S.
TAILSTOCK FEEDSCREW M.S.
TAILSTOCK CENTRE. M.S.
DRAWBAR. M.S.
CATCHPLATE CH.M.S.
LOCK SCREW
INDEX ARM M.S.
INDEX PLUNGER M.S.

overcome this, all my mandrels are shouldered down to ½ in. at the driving end and one special carrier does for the lot. This carrier, a sketch of which is given, has a ½-in. hole in which the mandrel ends are gripped by an Allen screw. The tang, which has a flat each side is brazed in. A simple non-slip drive is thus obtained with the driving plate screws no more than finger tight.

Draw-Bar

As mentioned before, the draw-in feature is optional but a sketch of the draw-bar as used on my own machine is given.

Feed Lever Holder. M.S.

It was explained in the previous article that when gears with a very steep spiral angle are being cut it is necessary to transfer the feed lever to the dividing head. This part receives the feed lever in this case and is either pressed into a ⅜-in. hole in the worm bracket or secured there by a set-screw.

Tailstock Body. C.I.

The first job is to machine the front face by a surfacing operation with the casting held in the four-jaw chuck. This done, the job is reversed and the rear surface treated in the same way. These two surfaces are now marked out for the positions of the locating tongue, feedscrew tap hole and barrel housing. Note that the centre height of the barrel housing is ¼ in. less than that of the dividing head. The tongue and seating surfaces are first machined by end-milling, using methods already described. When this has been done the positions of the two slots for holding-down bolts, are marked out. These can be end-milled out by easy stages or the bulk of the metal removed first by drilling and finished off with the end-mill. I find the neatest job can usually be done by milling out of the solid as drilled holes tend to make the end-mill snatch and produce uneven work. The upper surfaces of the lugs in which the slots are located can be trued up by milling, shaping or filing. The boring of the housing is done on a faceplate angle bracket. As it is important that the barrel and centre should be parallel to the locating tongue, the squareness of the tongue to the faceplate should be checked off before boring. After drilling and boring out, a reamer is used if available for final sizing. The tap hole for the feedscrew can be drilled out, it being hardly necessary to swing it in the lathe. There is no need to tap the hole right through the casting, about half-way will do, the rest of the hole being relieved by counter drilling. The only work now left on this part is to split the top half of the casting and drill and tap the hole for the clamping screw. A similar operation has already been carried out on the sliding block and rotating sleeve.

Tailstock Barrel and Centre

The material for this part is ⅝-in. ground silver steel bar. The only operation for the time being is to shoulder one end of the blank down to ½ in., the centre end being left plain.

Feedscrew. M.S.

A length of 1½-in. round steel bar is called for here together with plenty of patience and cutting oil. Otherwise the machining is all straightforward. Regarding the ⅜ in. square groove, it is advisable to use knife tools for this on a light lathe rather than attempt to use a parting tool. With regard to the knurling of the knob, if your lathe is not heavy enough to tackle this diameter it can be cut after the fashion of a lighter wheel on the machine when completed.

Link. M.S.

This part is made from standard B.D.M.S. bar 1 in. × ⅜ in. The jaws are made a close fit in the square groove in the feedscrew and the inside of the jaws should fit without play over the bottom of the groove. The shouldered end of the tailstock barrel fits into the ½-in. hole in the link and is secured there by a taper pin. The jaws on the link can be case-hardened with advantage.

Clamping Screw and Lever. M.S.

This part is similar to the one required for clamping the swinging arm and the two can be made up together. In my own case I have used the small black bakelite knobs that can be procured commercially already tapped, but if preferred, the knobs can be turned from steel solid with the levers or omitted altogether.

One further operation to be done on the tailstock unit is the turning down of the centre. To ensure alignment of the two centres I adopted the following method ; the tailstock unit is assembled and the dividing head complete with centre fixed in position on the machine table. The tailstock is now slid along the groove of the table bringing the blank end of the tailstock barrel smartly up against the dividing head centre to make a " pop " mark. The barrel is now removed and held in a four-jaw chuck and the centre pop set to run truly. The end of the barrel is now turned down to a 60 deg. cone as shown in the drawing. Rather a left-handed way of doing a job perhaps and hardly orthodox practice but the end justifies the means.

(To be continued)

Railway Films

We have received a copy of a catalogue of 16-mm. sound films and film strips issued by British Railways, London Midland Region. The subjects cover a wide field of educational, travel and general interest, and the films are available for loan, free of charge, to schools, clubs, societies and other institutions. Certain conditions have to be observed, but they are not very onerous and are fully set out in the catalogue. Most of the films are in monochrome, but some are beautifully presented in colour.

The catalogue is obtainable from the District Passenger or Goods Manager, British Railways, L.M. Region, in any of the large towns, or from Euston Station, London. The films we have seen we have found most enjoyable.

IN THE WORKSHOP

by "Duplex"

*36—Additions to Machine Tools

(4) Attachments for increasing the speed range of the drilling machine

ALTHOUGH the small "Champion" drilling machine of ½-in. capacity is intended for drilling at high and medium speeds, its usefulness in the small workshop will be greatly increased by the addition of an attachment providing a range of low speeds more suitable for countersinking and counterboring operations.

This attachment, although it incorporates two V-belt drives, is of rather different design to the type previously described for the larger machine, and as there is, in addition, such a large number of the smaller machines in use, a detailed account of the construction of the device may be of interest to many.

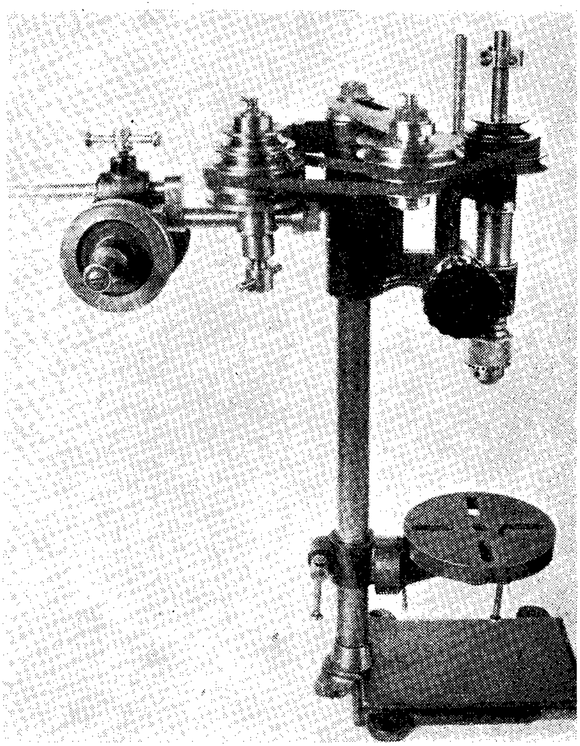


Fig. 1. The "Champion" drilling machine with speed range attachment

The photographs in Figs. 1 and 2, and the general arrangement drawing will serve to give a general idea of the appearance of the converted machine, and the dimensions of the several parts and their constructional details are illustrated in the working drawings that follow.

At the outset, it may be pointed out that the construction of the machine itself is in no way altered, so that, if desired, it can at any time be readily returned to its original condition.

The primary drive is by a round belt from an electric motor attached either on top of or below the bench; but where the drive is taken from a countershaft situated above the machine, this contingency has been met by locating the jockey pulley assembly so that it can be turned upwards on its shaft, in order to maintain the belt alignment in the new position.

It will be apparent that the jockey pulleys are of necessity carried farther away from the column than in the standard machine; this imposes a greater bending leverage on the rather slender column, and it may, in consequence, be found advisable to overcome this difficulty by fitting a support between the projecting end of the jockey pulley shaft and the driving unit, or by anchoring this support to the bench top.

To increase the speed range by making three steps of the first driven pulley available for the V-belt drive, a fourth step is added to this pulley and is used solely for the round belt drive.

The spindle carrying the second or intermediate pulley is attached to an arm bolted to the upper end of the column; as this arm is slotted, it can both rotate and slide on its securing bolt in order to allow the two V-belts to be slackened, or tightened automatically to the same tension.

The range of speeds obtainable is from 200 to 4,600 r.p.m. when using a pulley, having steps of $1\frac{5}{16}$ in., $2\frac{5}{16}$ in. diameter, fitted to the driving shaft of a motor rated at 1,450 r.p.m.

Construction of the Attachment

Reference to the drawing will show that the attachment is composed of two separate units, namely, the assembly (A) which carries the intermediate pulley, and the assembly (B)

*Continued from page 484, "M.E.," April 21, 1949.

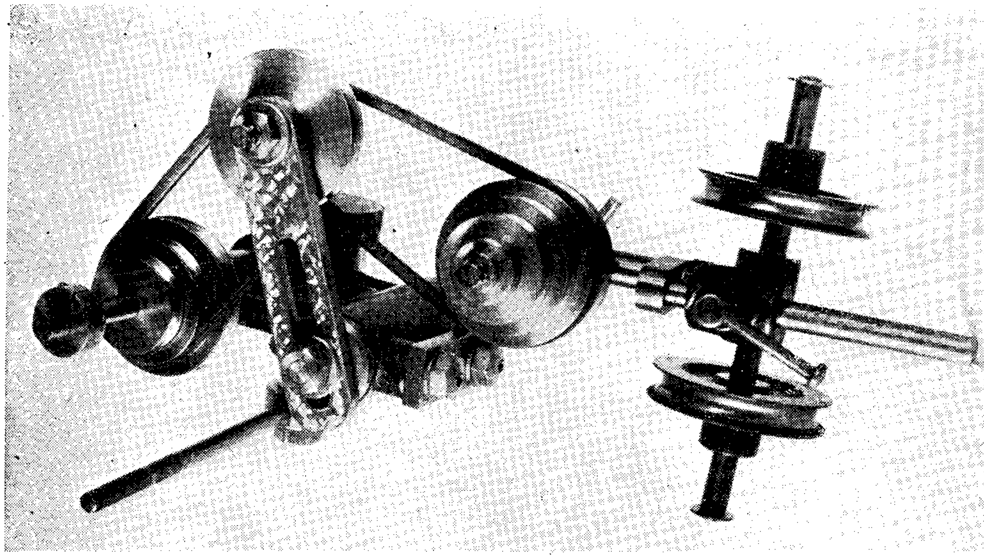


Fig. 2. The conversion seen from above

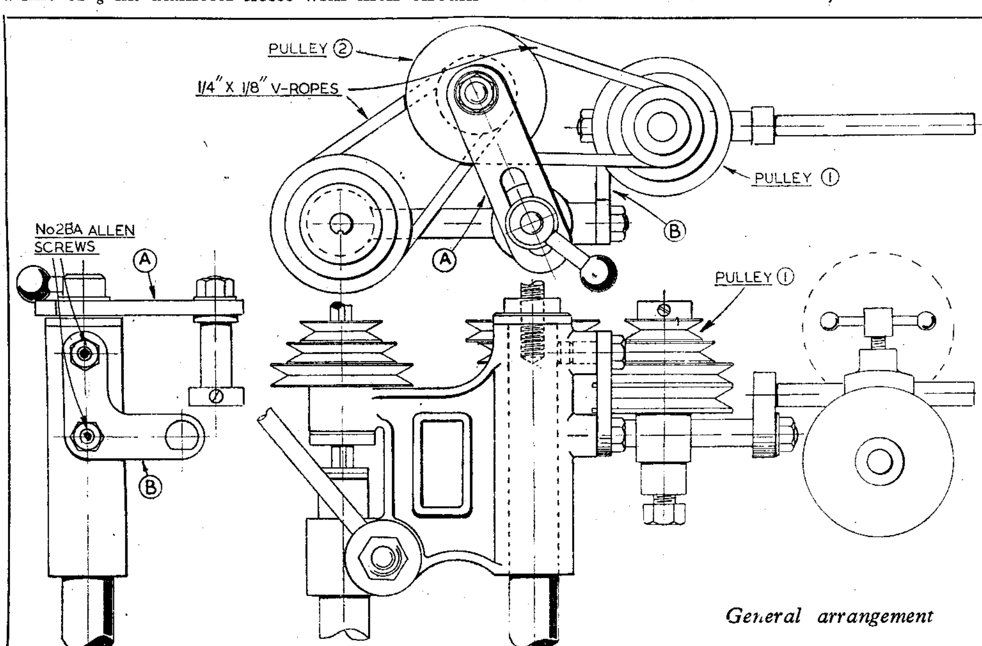
mounting the first driven pulley and the jockey pulleys.

The Intermediate Pulley Mounting. Assembly (A), Figs. 3 and 4

The arm (1), made from 1-in. × ¼-in. flat mild-steel, is slotted as shown in the drawing in order to provide for the adjustment of the two V-belts. The slot is most easily formed by drilling a line of ⅜-in. diameter holes with their circumferences a short distance apart, and then removing the intervening metal with a round file to finish the slot to shape.

The end of the drill column will have a good appearance, and the slotted arm will be afforded a flat bearing surface, if a specially made washer of the form shown, is fitted to the stud set in the top of the column.

To drill the column to receive this stud, (2), the work is centred in the four-jaw chuck and its



General arrangement

outer end is supported in the fixed steady; a centre drill is then employed to form the centre for the letter P or 21/64-in. diameter tapping size drill that follows. The hole so formed is opened out to the clearing size for a depth of some 3/32 in., and a final facing cut is taken over the end of the column.

be made, for it will usually be found easier to fit a shaft to a bored bearing rather than to reverse the operation.

This pulley, like its fellow, the No. 1 pulley, depicted in Fig. 8, is made of cast-iron to resist wear, and the belt grooves should, in accordance with the belt makers' recommendations, be

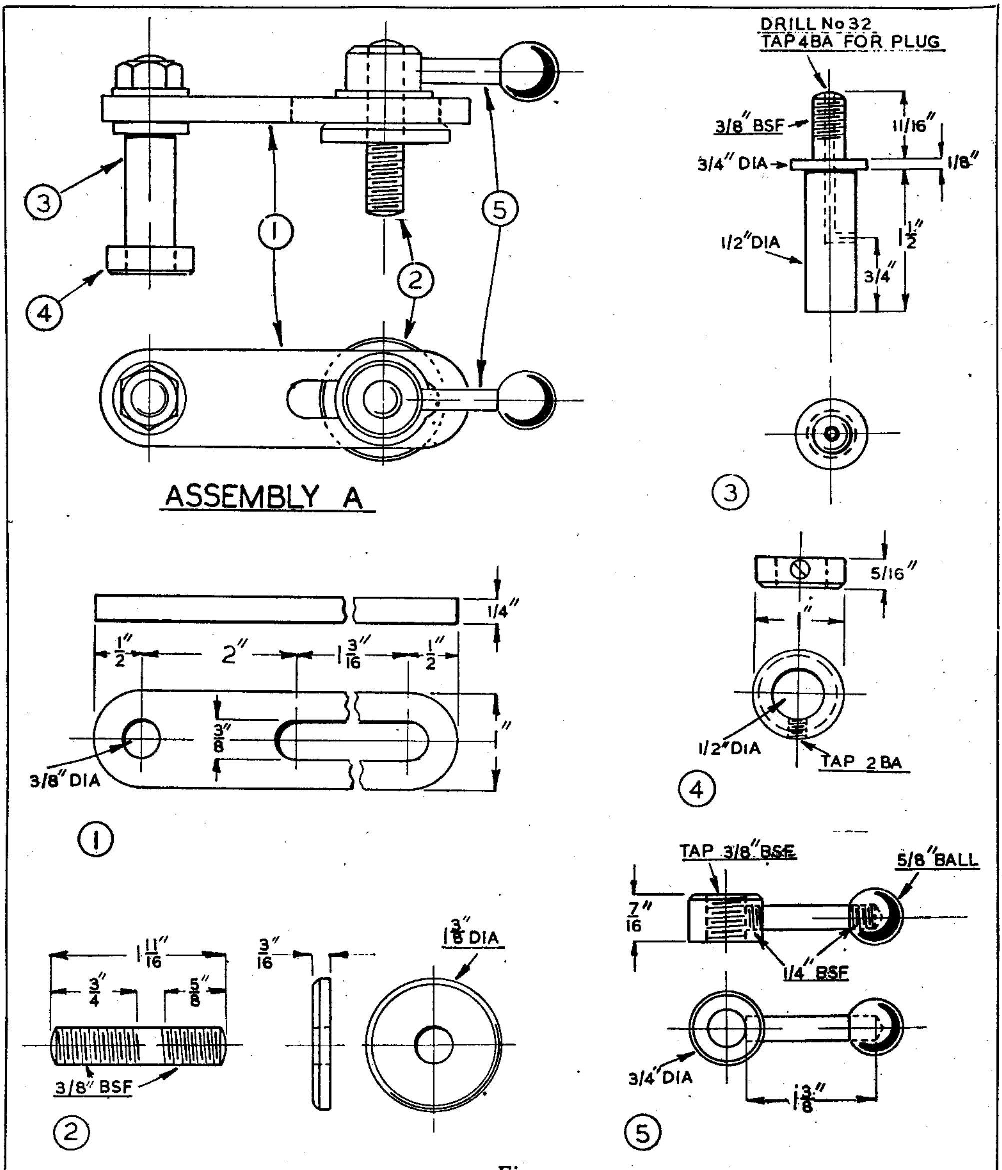


Fig. 3

The tap is guided by the tailstock chuck to ensure that it is started truly, and the tapping operation can then be completed with the work gripped in the bench vice.

Before the pulley spindle (3) is machined, the intermediate pulley shown in Fig. 4 should

machined to an included angle of 40 deg. in order to afford an efficient drive.

Machining the V-Pulleys

The pulley casting is secured as nearly centrally as possible in the four-jaw chuck and, after the

end has been faced, the casting is drilled and bored to within a few thousandths of an inch of the finished diameter to allow for the subsequent reaming operation.

The next step is to press the bored casting on to a well-fitting mandrel, mounted between the lathe centres, in order to face the other end surface and to machine the V-grooves.

The pulley steps are first turned to their finished diameter, and a narrow parting tool, preferably mounted in the back toolpost, is then fed in for the full depth of the belt grooves.

A form-tool with its end shaped to an included angle of 40 deg., is clamped in the back toolpost, and the sides of the grooves are machined until the correct width has been obtained.

The pulley bores should be reamed after machining, and a final lapping operation will ensure both quiet running and good wearing qualities.

The spindle (3) is turned from mild-steel to a diameter some one-thousandth of an inch over its finished size; it is then lapped to an accurate working fit in its pulley.

Provided that adequate lubrication is maintained and overloading is avoided, a machine spindle of unhardened mild or alloy steel running in a cast-iron bearing will be found to have a long working life, which will, of course, be increased if the steel shaft is case-hardened prior to being lapped.

It is advisable to drill the spindle axially, as illustrated in the drawing, to form an oil-way which can be fitted with either a screwed plug, or a cycle type lubricator as shown in the photograph, Fig. 2.

The collar (4), which retains the pulley, is bored to fit the spindle and tapped to receive the set-screw that secures the part in place.

Changing the belts on the pulleys to alter the drill spindle speed will, of course, be facilitated

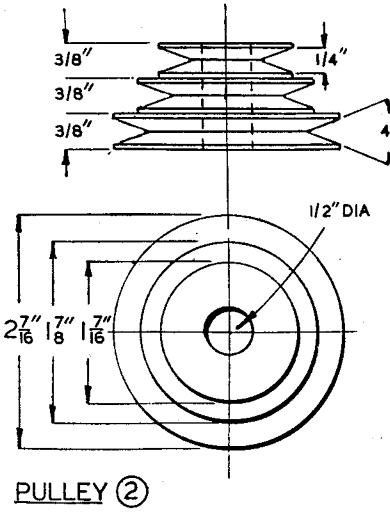
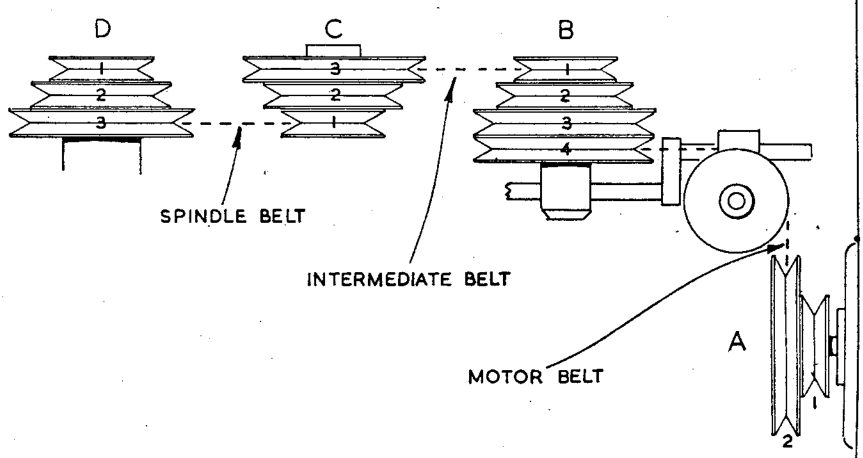


Fig. 4



MOTOR BELT	INTER BELT	SPINDLE BELT	SPEED R.P.M.	MOTOR BELT	INTER BELT	SPINDLE BELT	SPEED R.P.M.
A1—B4	B1—C3	C1—D3	200	A1—B4	B2—C2	C3—D1	1450
A2—B4	B1—C3	C1—D3	400	A2—B4	B2—C2	C3—D1	2600
A2—B4	B1—C3	C2—D2	800	A2—B4	B3—C1	C3—D1	4600

The speed range table

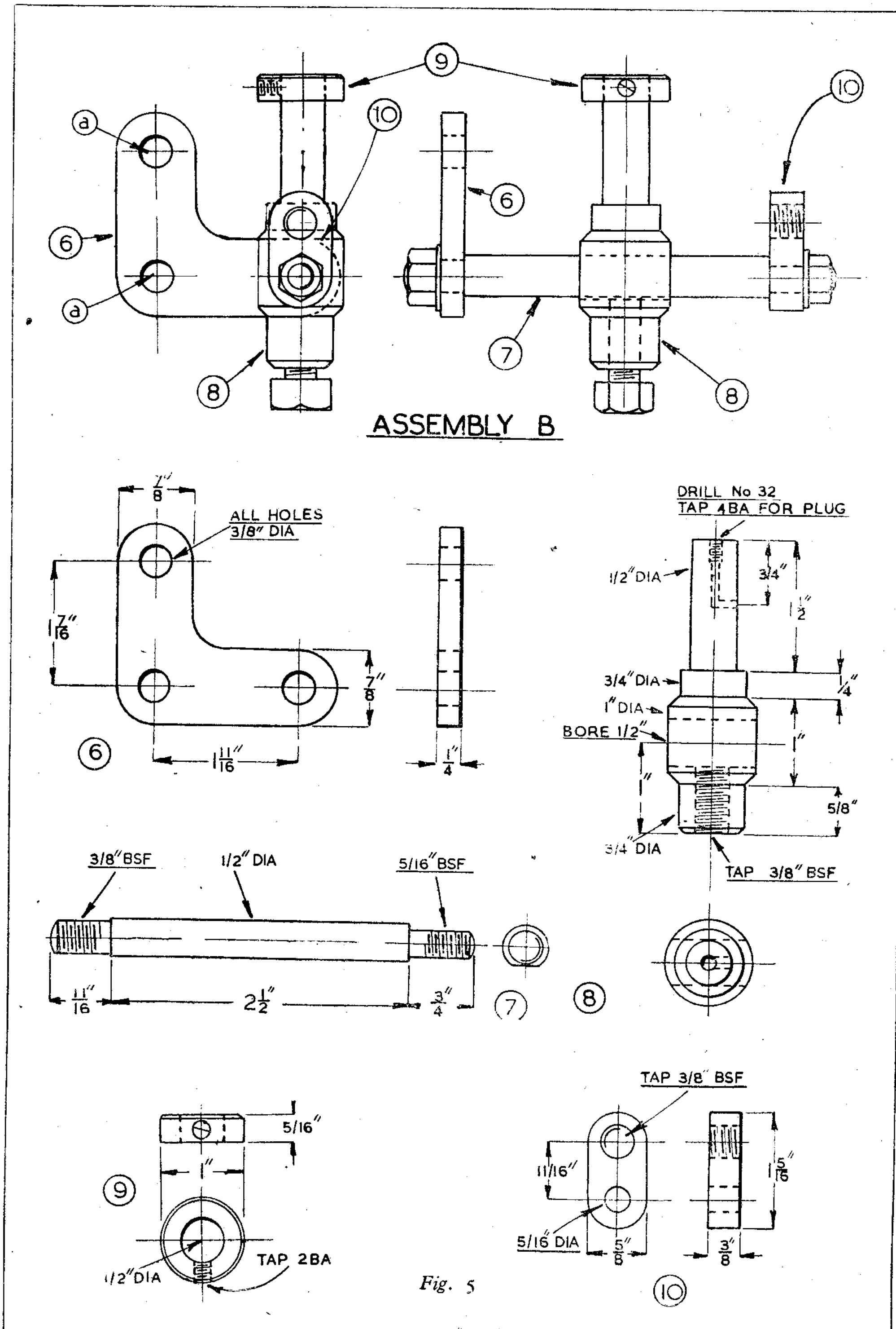

9
10
a
6
a
8
6
7
8
10
ASSEMBLY B
7/8"
ALL HOLES
3/8" DIA
1 7/16"
7/8"
1 11/16"
6
1/4"
DRILL No 32
TAP 4BA FOR PLUG
1/2" DIA
3/4"
1 1/2"
3/4" DIA
1/4"
1" DIA
BORE 1/2"
1"
1"
5/8"
3/4" DIA
TAP 3/8" BSF
3/8" BSF
1/2" DIA
5/16" BSF
11/16"
2 1/2"
3/4"
7
8
5/16"
1"
9
1/2" DIA
TAP 2BA
TAP 3/8" BSF
11/16"
1 5/16"
5/16 DIA
5/8"
3/8"
10

Fig. 5

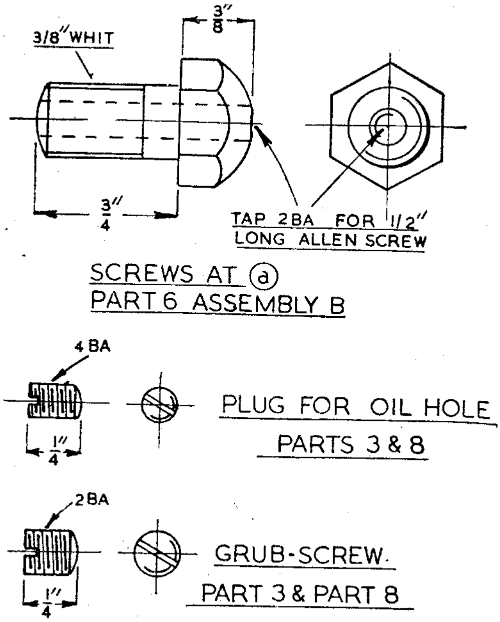


Fig. 6

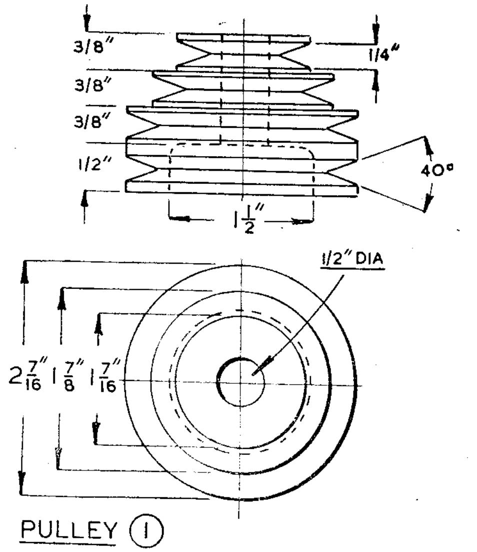


Fig. 8

by fitting a ball-ended handle (5) to the stud set in the column, but if preferred, a $\frac{3}{8}$-in. B.S.F. hexagon nut can be used for this purpose as will be seen in the photographs of the machine.

The Mounting for the Driving and Jockey Pulleys. Assembly (B) Fig. 5

Both the driving and the jockey pulleys are attached to the headstock of the machine by the L-shaped bracket (6), which is secured in place by means of the two hexagon-headed screws shown in Fig. 6; it should be noted that no fresh holes need be drilled for these screws, as the two existing holes tapped $\frac{3}{8}$ in. Whitworth are used.

These screws are drilled axially and tapped to receive the 2-B.A. Allen screws that serve to clamp the headstock casting to the column; the constructional details of the parts are illustrated in Fig. 7.

To allow the L-bracket to bed evenly on the two screwed lugs formed on the headstock casting, these two bosses should be filed flat or, if preferred, the casting can be set up on the lathe saddle and the surfaces trued by a milling or a fly-cutting operation.

The pivot (8) is fitted to its pulley in the manner described for the pivot (3), but in addition, it is cross-drilled and reamed to $\frac{1}{2}$ in. diameter to allow it to slide on the shaft (7), where it is secured by means of either a hexagon-headed or a cross-handled screw.

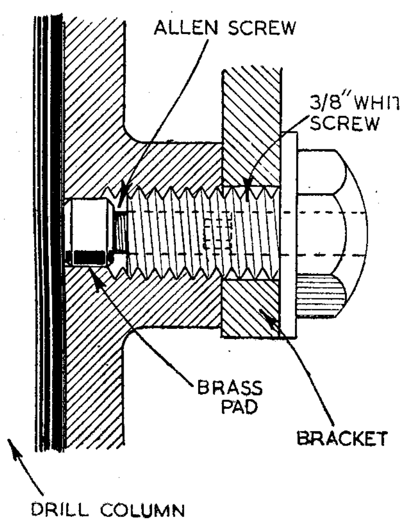


Fig. 7

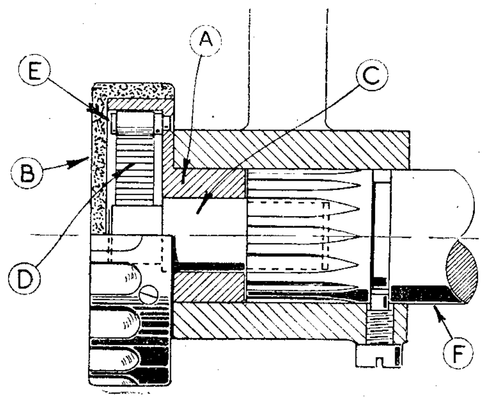


Fig. 9

The cross-drilling operation is best carried out by mounting the shaft crosswise in the four-jaw chuck with its centre-line set to correspond with the centre height of the lathe. This setting can be checked by applying the test indicator to the chuck jaws. The position of the hole's centre on the long axis of the shaft is set with the this means, the two belts are automatically set in equal tension.

Care should be taken always to tighten the belts sufficiently, as slipping materially shortens the working life of the belt.

The speed range obtainable when the attachment is fitted is given in the table on page 551.

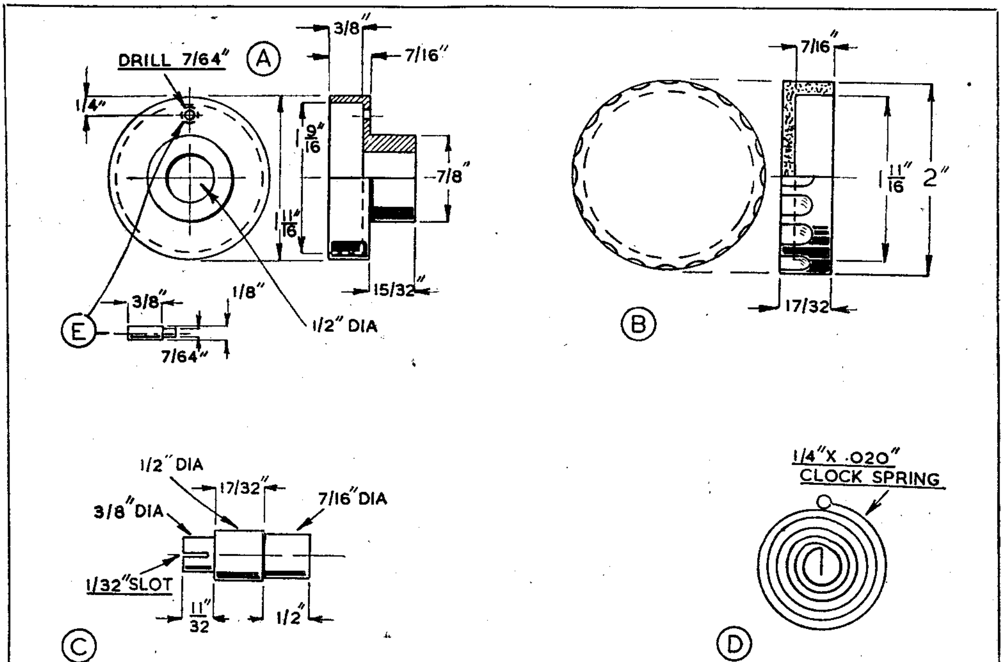


Fig. 10

aid of the tailstock centre, or by reference to a tool set at lathe centre height.

To align the pivot vertically when assembled on the drilling machine, a flat is formed on the under surface of the shaft (7) preferably by a milling or a fly-cutting operation.

The small bracket piece (10) is secured at its lower end to the shaft (7), and its upper end is tapped $\frac{3}{8}$-in. B.S.F. to receive the jockey pulley shaft which carries the standard jockey pulley assembly.

The distance between the upper and lower holes in the bracket (10) is arranged so that the correct alignment of the driving belt is maintained in the event of the jockey pulleys being turned upwards to accommodate an overhead drive.

The two V-belts used are those designated No. 1007 by the manufacturers, Messrs. J. H. Fenner & Co.; these belts are $\frac{1}{4}$ in. wide, $\frac{1}{8}$ in. thick, and 12.9 in. in length on the inside measurement.

When the drilling machine is in use, the belts are adjusted by pulling on the upper end of the pivot attached to the swing arm, and then securing the arm in place by tightening the nut or handle fitted to the stud at the top of the column; by

Adjustable Tension Device for the Return Spring

The attachment fitted to the drilling machine previously described can, with some modification, be applied to the "Champion" machine.

As has already been pointed out, in order to ensure that the spring tension remains nearly constant throughout the movement of the feed lever, a spring composed of many turns of light gauge steel should be fitted. However, in small drilling machines the space provided is not always sufficient for housing a spring of this type, and it is then necessary to fit a larger spring box to accommodate the new spring.

The general construction of the attachment is illustrated in Fig. 9, which shows that the spring box itself (A) is fitted to the pinion tunnel and in turn provides a bearing for the projecting end of the pinion shaft (C).

The spring (D) is anchored at one end to the pinion shaft, and at the other to the stud (E) fitted to the housing.

The cover (B), which is secured to the housing by means of a grub-screw, is therefore rotated to wind up the spring and set its working tension.

(*Continued on page* 556)

A Modified Fixed Steady

by "Tyro"

TO a novice, the accurate centring of a long shaft in the jaws of a fixed steady which are not positively operated, can be quite a tedious business. It was for this reason that I decided to convert the jaws of the steady provided for my M.L.7 to screw operation, thus making simple the task of obtaining a spot-on reading from my "clock" in contact with a work-piece supported in the steady. The conversion also gave me the added advantage of making it wellnigh impossible for the jaws to back away from their job under pressure from a heavy cut.

The existing bronze jaws and clamping bolts were used, and briefly the idea consisted of drilling and tapping the square ends of the steady jaws and providing for each a long adjusting screw, threaded to suit. The clamping bolts were cross-drilled to accommodate the tips of the adjusting screws turned to an easy fit, and then drilled and tapped axially to receive a small keep screw, the end of which fitted into an annular groove turned in the end of the adjusting screw, allowing it to rotate freely but preventing any longitudinal movement. It will be seen therefore, that when the adjusting screws are turned, the steady jaws move in and out in their guides depending on which way the screws are turned. When the desired setting has been obtained, the nuts on the clamping bolts are tightened in the usual way.

The method of manufacture was as follows:

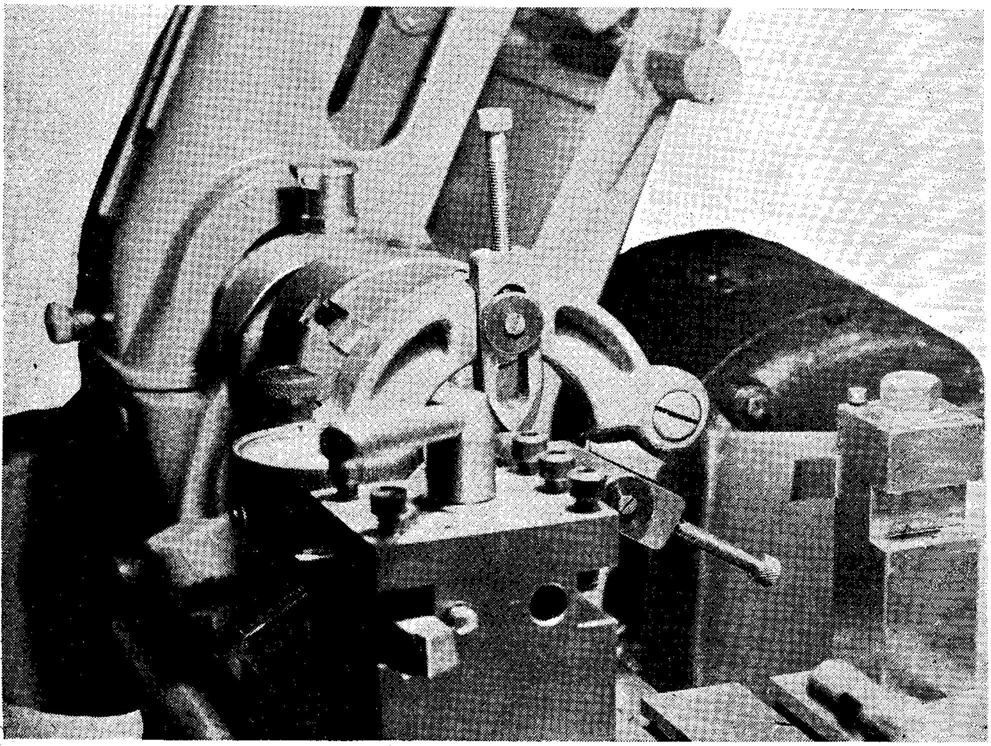


Photo by] [*W. M. Boulton*

All set for work

Three adjusting screws, each identical, were made first, from $\frac{3}{8}$-in. brass rod chucked, faced, centred and supported by the back centre and turned down to $\frac{1}{4}$ in. diameter for a length of $2\frac{1}{8}$ in. and then threaded $\frac{1}{4}$ in. B.S.F., left hand, by means of a die held in the tailstock die-holder, for all but $\frac{3}{8}$ in. of the turned length. Left-hand thread was employed so that when the adjusting screws were rotated in a clockwise direction, the steady jaws advanced towards the work. A right-hand thread would work just as well of course, but would be inconsistent with normal feedscrew practice. The smaller end of the adjusting screw was then further reduced to a couple of thousandths under 5/32 in. for a length of $\frac{1}{4}$ in. and the next $\frac{1}{8}$ in.

chamfered with a 45-deg. chamfering tool. A $\frac{1}{8}$-in. wide parting tool blade, secured in the back tool post, then did its stuff and a groove 1/32 in. deep was cut in the end of the screw $\frac{3}{16}$ in. from the tip. Before parting off at the other end of the work, a $\frac{1}{4}$ in. of the full diameter was knurled with a pair of medium wheels.

Next, each steady jaw was dealt with at the same time as its own clamping bolt. The square end of the jaw was marked out and centre-popped and the jaw clamped truly vertical with its own bolt to an angleplate set up on the drilling machine table. A 5/32-in. drill was then put through the jaw and the bolt at one operation. The two parts were then separated, the hole in the jaw being opened out with a No. 4 drill and tapped $\frac{1}{4}$ in. B.S.F. left hand, while the hole in the clamping bolt was countersunk on one side with a 90-deg. countersink. Next the bolt was chucked in the three-jaw and drilled axially with a No. 32 drill until the cross drilling was broken into, countersunk, and then tapped 4 B.A. All that then remained to be done was to get three 4-B.A. setscrews with countersunk heads and reduce the tips of each to $\frac{1}{8}$ in. diameter for a distance of about $\frac{1}{16}$ in. and then assemble each jaw with its adjusting screw, clamping bolt and keep screw, and by trial and error and a smooth file, arrange for each keep screw to bed down on its countersunk face firmly and retain the adjusting screw while allowing it to rotate freely. The photograph shows the finished article set up for a job of work.

Readers may be interested in the two toolposts which can be seen in the photograph. The larger one replaces the top slide for all straight turning jobs and was machined from a piece of $2\frac{1}{2}$ in. × 2 in. B.D.M.S. One tool station takes $\frac{3}{8}$ in. sq. tool bits, while the other is designed for $\frac{5}{16}$-in. bits. The smaller hole accommodates home-made boring tools made from $\frac{1}{4}$ in. round silver steel, and also the shank fitted to the writer's "clock" which can be seen in position ready to check the truth of the work held in the steady. The larger hole is actually bored 1 M.T. and is very useful for use with M.T. shanked drills which can be fed with the lathe power traverse into work held in the chuck. The tailstock chuck also fits into this socket so that small work can be traversed across an end mill or similar cutter held in the lathe chuck. The toolpost is secured to the boring table by means of a removable stud screwed into a specially drilled and tapped hole in the table. The stud is an accurate fit in the reamed hole of the tool post, so that no horizontal movement is permitted.

The back tool post is a very simple affair made from $1\frac{1}{4}$-in. sq. bright stock. A dovetail is machined integral with the base, to be an accurate fit in the sides of the tee slot in the boring table, and ensures that the two tool stations are truly at right angles to the lathe axis. Commercial parting tool blades $\frac{1}{2}$ in. wide × $\frac{1}{16}$. 3/32 or $\frac{1}{8}$ in. thick are used upside down in one station, clamped by two 4-B.A. cap screws. This method of fitting proved to be sufficiently rigid to withstand a hang up which occurred during the testing of the device due to really brutal treatment. Everything held firm and the end of the parting tool blade had no option but to break smartly in two and fly across the workshop with a loud ping!

The other tool station, when the whole tool post has been turned through 180 deg., normally houses a chamfering tool, but is designed to hold at correct centre height, a hinged knurling tool such as that described by "Duplex" in the issue of THE MODEL ENGINEER dated January 1st, 1948. Knurling from "the other side of the counter" makes the inspection of the work as knurling proceeds, a much simpler matter. The toolpost is secured to the last tee slot in the boring table by means of a $\frac{3}{8}$-in. tee bolt, and takes up so little room that it more or less permanently lives there.

In the Workshop

(*Continued from page* 554)

Constructional Work

The detailed dimensions of the several parts are shown in the working drawings in Fig. 10.

The body (A) of the attachment is best turned from a length of mild-steel, and the inner bore should be reamed to size, as it affords a bearing for the extended portion of the pinion shaft.

The register on the body should be made a firm rotating fit in the pinion tunnel so that it will stay in position after the body has been turned to set the spring tension. If the fit is made too slack for this purpose, a grub-screw must be fitted to the headstock casting to lock the register in place.

The spring peg (E) should be either screwed or pressed into place and its end is then lightly riveted over.

The cover (B) for the spring box can quite well be made from the lid of a container used for marketing various toilet preparations; these lids are made of plastic material and have a fluted surface to afford a finger hold. After the lid has been bored to size, it is fixed to the spring box by means of a No. 8 B.A. screw.

To provide anchorage for the inner end of the new spring, an extension-piece (C) is fitted to the pinion shaft.

For this operation the shaft is gripped to run truly in the four-jaw chuck, and its end is drilled and then bored to a diameter of $\frac{7}{16}$ in. for a depth of rather more than $\frac{1}{2}$ in.

Next, the extension-piece is machined to a good working fit in the bore of the spring box, and its end portion is turned to a diameter of $\frac{7}{16}$ in. plus one-thousandth, to make it an interference fit when in the vice it is pressed into place in the pinion shaft.

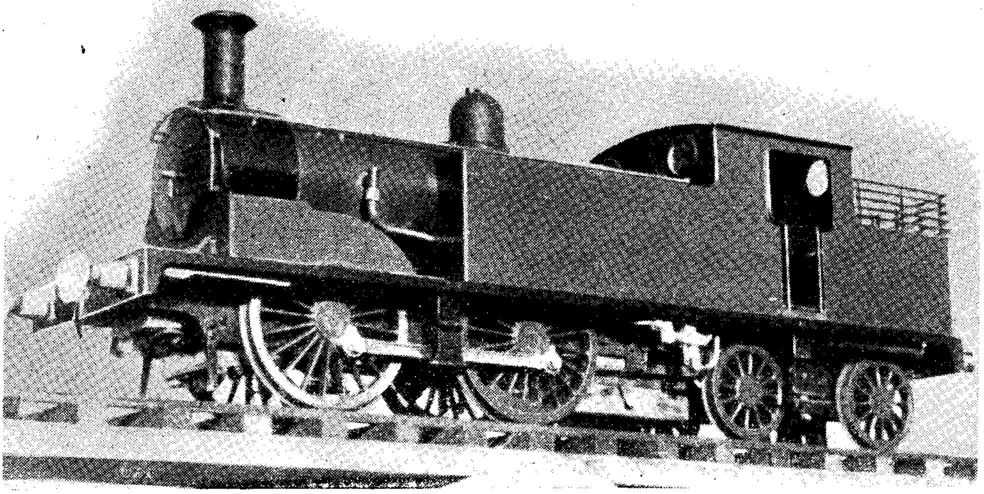
To form the anchorage for the inner end of the spring, the projecting end of the extension-piece is cross-cut with a hacksaw to a depth equal to the width of the sping fitted.

A discarded clock spring will serve for making the spring (D), which is put in place after the other parts have been fitted to the drilling machine.

Finally, the spring is set to the correct tension for raising the drill spindle to its full height by turning the spring-box cover in a counter-clockwise direction.

A Southern "M.7"

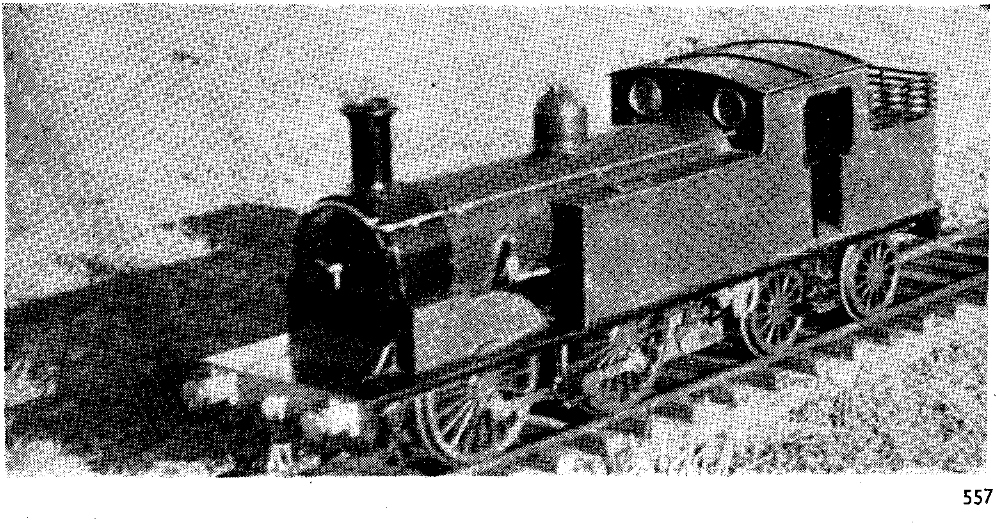
Mr. H. C. Buckingham describes a "first attempt" which ends in success



THE engine seen in the photographs herewith is the first I have built. She is a $3\frac{1}{2}$-in. gauge Southern M.7 (Drummond tank). I started taking THE MODEL ENGINEER in 1943, when a friendly woman in a bookstall asked if I would like it, as someone had given it up. Well, someone's loss was my gain, and I was soon bitten by "L.B.S.C.'s" bug, and at Christmas, 1943, I had made an outline drawing of the "M.7." I found "L.B.S.C.'s" "Petrolea" which he was then describing, had just the "works" I wanted, and with the aid of my wife's pastry-board, I was able to draw out my details, using "Petrolea" as a guide.

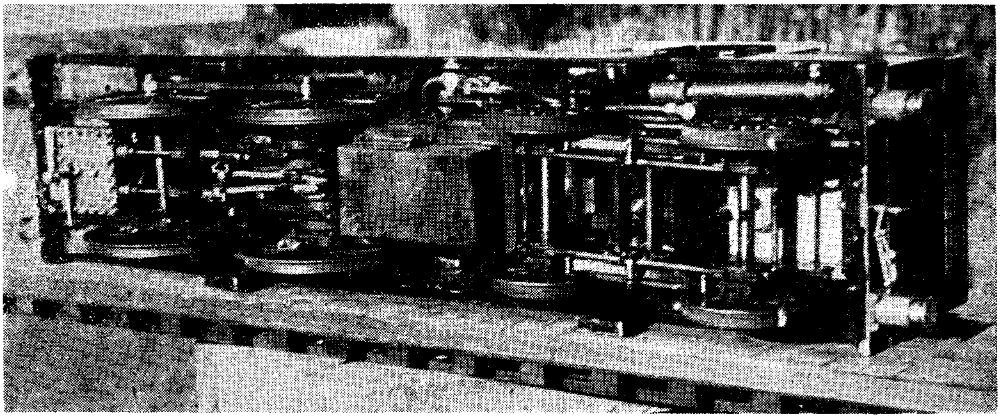
Meanwhile, I was getting an old 4-in. Drummond lathe in working order and fitted up with a motor and countershaft. I was lucky (it was wartime) to get some wheel castings the right diameter, from Bassett-Lowke's, although the driving wheels were $\frac{11}{16}$ in. scale and had too many spokes, and I soon got started.

Just about that time I found that a model club had been formed in my town (Godalming); so I went along to a meeting and joined. I soon made some friends who helped me and gave me much encouragement. Progress seemed slow, but, later on, when I had the motion completed and the boiler brazed and silver-soldered, we



had a small exhibition and competition at Godalming, and she was awarded the championship cup. I also entered it in Vickers open competition in 1947 (she was still unfinished) and was awarded the V.H.C. Diploma.

The locomotive was finished in the spring of 1948, and proved very successful, although I am not satisfied with the injectors; I've made five, but none are as they should be. She has been busy at local fetes and exhibitions, passenger-hauling on the Godalming Club's track, and has a very lively performance. If one is heavy-handed with the regulator when starting, she will slip and sound more like one of Mr. Westbury's engines than a locomotive! I have now started to build "L.B.S.C.'s" "Doris," but have not got very far yet. The photographs were taken by Mr. K. Larbey, of Guildford.



The model "M.7" from underneath

PRACTICAL LETTERS

Compound Tractors

DEAR SIR,—Your correspondent, Mr. Bretherton, in his letter in the February 10th issue of THE MODEL ENGINEER, records that compounding, in traction engine (or tractor) design, was of doubtful advantage. After a very considerable practical experience in maintenance and operation of Fowler, Foden, Tasker, Foster, Marshall and McLaren, and last, but not least, in favour, a Burrell compound, I must say that, irrespective of the duties assigned, a compound gave a very good all-round performance and was very economical in use of fuel and water.

No traction engine, when handled intelligently, gave the slightest trouble, whether single-cylinder or otherwise, with regard to getting on dead-centre, always allowing for the general standard of maintenance. A single-cylinder job, when allowed to get in bad condition, would obviously be more tricky to handle with a heavy load in towns amongst thick traffic; but to those, who have no experience of traction engine operation, the abilities of even a single, would astound them. The general docility of a steam engine, and the large flywheel fitted usually to singles, enabled a good driver to perform "impossible" manoeuvres at times.

I have the idea that the reference to "much starting and stopping" not favouring the compound, is due to an idea coming from the published results of railway locomotive operation —perfectly correct in this latter case. But where road locomotives are concerned, without any superheating and using steam-jacketed cylinders, compounding was fully justified.

Has your correspondent ever backed up to a real load (I don't mean a threshing box, or something) of about 30 or 35 tons of payload and 12 tons of tare weight in addition, dropped the reversing lever forward again, thrown two or three shovelsful of black diamonds on each side of the firebox, closed the firebox door, lightly pulled the whistle cord, noticed which crank was up, and pushed on the big brass auxiliary knob if low-pressure crank was "up" (if the H.P. was "up" regulator only), and as soon as the engine got under way, pulled the reverse lever back to third notch?

If your correspondent has had the above privilege, then I am surprised at his assertions; if not, as a lover of traction engines, he has certainly missed something.

Certain engines, amongst them the Foster, got away from rest on the auxiliary, in a very quiet lady-like manner. Other engines, including Foden's largest type of road locomotives which had full simpling gear, let you know their determined intention to start off a big load.

But could these compounds be restarted after stopping? Just watch and listen while I pull the simpling gear over to double high pressure. CHOFF—CHOFF—CHOFF—change over—SHUFF, SHUFF, SHUFF, SHUFF. By Gad, sir! and 30 or 40 tons in easy motion like that.

Yours faithfully,

Blackpool. ARTHUR WEDGWOOD.

Earthing Electrical Appliances

DEAR SIR,—In connection with the prevention of accidents to users of electrical appliances of all types, both in the workshop and home, may I draw attention to the somewhat misleading statement referring to a miniature electric furnace in the April 7th issue.

Although not specifically stated, I gather that the casing of same is of metal, since it is provided with an earthing terminal, and should point out that it may be most desirable from a safety point of view to use this under certain circumstances, whether the appliance is on lighting or power supply—since a shock from either can be equally dangerous.

The point to watch is that where any metal-clad electrical appliance is used in the proximity of stone or concrete floors, or any conducting materials with which the user may come into contact (including water, etc.), and thereby provide a path to earth *via* his or her body for any leakage current, the earth terminal should be efficiently connected direct to a proper *electrical* earth, the most convenient form of which is usually an incoming or rising cold water pipe.

The reason is, of course, that the human body offers a comparatively high resistance, and electricity, like most things, will always take the easiest path, and if the leakage is heavy enough, blow the fuse and thus disconnect the appliance without harm to the user.

I should stress that the majority of such appliances are soundly constructed and safe under nearly all conditions *when new*—it is after considerable use, when the appliance has been knocked about a bit, and flexes and insulation generally deteriorated somewhat, that danger arises.

Under the circumstances referred to, the most convenient way to use such articles is, of course, by means of a three-core flex from a proper socket outlet, which, if correctly installed, should be of the three-pin type with the third pin already efficiently earthed.

All this, of course, is probably elementary to the majority of readers but useful to those not electrically-minded who may otherwise take the statement referred to rather too generally.

Yours faithfully,
Birmingham. ARTHUR J. WEBB.
Grad.I.E.E.

[We agree entirely with our correspondent's advice, but would point out that in making the statement referred to, we were simply quoting, without comment, information supplied by the makers of the furnace.—ED., "M.E."]

A Veteran Gas Engine

DEAR SIR,—I think some of your readers may be interested to know that a gas engine installed in 1894 is still working in Cockermouth on full load every day in the week. The engine was built by Messrs. Tangyes Ltd., Smethwick, Birmingham, and is of the Otto Principle (Pinkney's Patent) and develops 5 b.h.p. The engine has no governor, and is used for driving a 3-throw ram pump that pumps water to a constant higher level. The speed of the engine is controlled by a cock fitted to the gas supply pipe.

In this modern world of speed and efficiency it is interesting to reflect on the so-called inefficiencies of the past. The above engine and pump was ordered April 10th, 1894, and despatched May 4th, 1894. Considering the weight and size of the apparatus, surely this is a record for quick service.

Yours faithfully,
Cumberland. R. NORGATE.

CLUB ANNOUNCEMENTS

The Ipswich and District Society of Model and Experimental Engineers

The above society has been in existence since 1944 and from a small start we have built up a membership of just over 100. Exhibitions have been held very successfully, both financially, and from the point of view of entries and attendances of the public.

The profits from the exhibitions, plus gifts from members and others interested, have enabled us to equip a workshop having a good range of small tools, a hand shaper, and two lathes, grinder and two drills, all motorised.

The workshop is at present rented, but negotiations are now in hand to purchase a piece of land on which we hope to have a building large enough for a workshop and meeting place where we can develop the social side.

Hon. Secretary: E. BLIGH-SMITH, 6, Paget Road, Ipswich.

West London Society of Model Engineers

Progress continues to be made and a number of new members have been welcomed recently. The first exhibition organised by the society was held at Wernington Road School, W.10, in conjunction with the annual exhibition of work of the Kensington Men's Institute. More than fifty models were on show, covering every aspect of model engineering, with the exception of model cars. Judging, which was very ably performed by Mr. H. E. White, of the North London S.M.E., resulted in the following awards: L.C.C. Silver Medal for the best piece of modelling.—Mr. Wm. Wheeler, $\frac{3}{4}$-in. scale G.N.R. "Atlantic" locomotive. First prize for marine models.—Mr. Geo. Coote, for glass case model of a steam yacht. First prize, beginner's effort.—Mr. Leslie Smith, fine scale "O" gauge, L.M.S. 4-4-0 class 2 express locomotive.

Despite the many other attractions at the exhibition, the model engineering section proved by far the most popular, and it frequently became necessary to close the door of the room in which the display was staged. Added attractions were the prize-winning locomotive shown operating under compressed air; a model showman's road locomotive made from scrap, electrically-driven, and a "OO" gauge 2-rail layout, shown working.

Hon. Secretary: E. J. OAKERVEE, 92, Harvist Road, N.W.6.

Harrow and Wembley Society of Model Engineers

On Wednesday, March 30th, Mr. Fred Cottam brought his prize-winning model locomotive along and gave an account of what was involved in the building of it. This locomotive is a $3\frac{1}{2}$-in. gauge model of one of the Great Western "King" class locomotives and has been constructed to conform to the prototype almost down to the last rivet. For the sake of fidelity, some of the smaller components are dummies, but for so small a model the variety of equipment which does actually work is truly remarkable. It has working sanding-gear, steam and vacuum brakes, atomised sight feed lubrication and tender scoop for travelling water intake.

Mr. Cottam commenced work upon it in 1937 but had to lay it up whilst he was serving in the Forces. He took it up again on his return, however, and completed it in time for THE MODEL ENGINEER Exhibition in August, 1948, where it took second prize in the locomotive section and also won the "Curwen" prize. Thus it represents about five years intensive work. After his talk, Mr. Cottam answered questions, and the meeting, which was very well attended, closed.

Hon. Secretary: J. H. SUMMERS, 34, Hillside Gardens, Northwood, Middx.